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Preparation of fresh TOMATOES

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for
MARKET



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THE TOMATO, which in the early part of the last century was regarded with suspicion and was said to be poisonous, has now become one of the most important of our vegetable crops. The only vegetable crop that exceeds the tomato crop in farm value is potatoes. During the last 5 years the farm value of the tomato crop in the United States has averaged nearly \$177,000,000 annually.

In the 5-year period 1943-47 an average of more than 809,000 acres was devoted annually to the production of tomatoes in the United States. Approximately 32 percent of this acreage was used for growing tomatoes for the fresh market, the remaining 68 percent of the crop being produced for canning and manufacture into tomato products. Production for the fresh market averaged about 30,000,000 bushels annually during the same period.

Tomatoes are highly perishable. The utmost care is necessary in the harvesting, handling, sorting, and packing operations if severe losses are to be avoided when the tomatoes arrive in the markets.

Much progress has been made in the methods of preparing tomatoes for market. This bulletin describes the practices that are successfully used and gives information and suggestions to growers and shippers for improving their own methods.

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PREPARATION OF FRESH TOMATOES FOR MARKET

By RAYMOND L. SPANGLER, *marketing specialist, Production and Marketing Administration*¹

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AREAS OF PRODUCTION

FRESH TOMATOES are produced in all of the States, but commercial production for market is confined to about 20 important producing States (fig. 1). Approximately 213,000 growers produce these tomatoes commercially. More than half of this number are producers of tomatoes for the fresh market. The others grow tomatoes for canning and manufacturing into tomato products.

The bulk of the carlot movement of fresh tomatoes originates in 5 States. Out of a total of 25,552 cars shipped in 1947, Florida, California, Texas, Mississippi, and Tennessee shipped over 22,800 cars. Table 1 shows the number of carlot shipments of tomatoes from leading shipping States for the 10 years 1938-47, and table 2 shows the monthly carlot movement in the United States for the same period.

¹ Acknowledgment is made of the assistance rendered by field representatives of the Production and Marketing Administration and State marketing officials, who supplied specific information relating to various producing areas for use in this publication. The first edition of this bulletin was written by F. Earl Parsons.

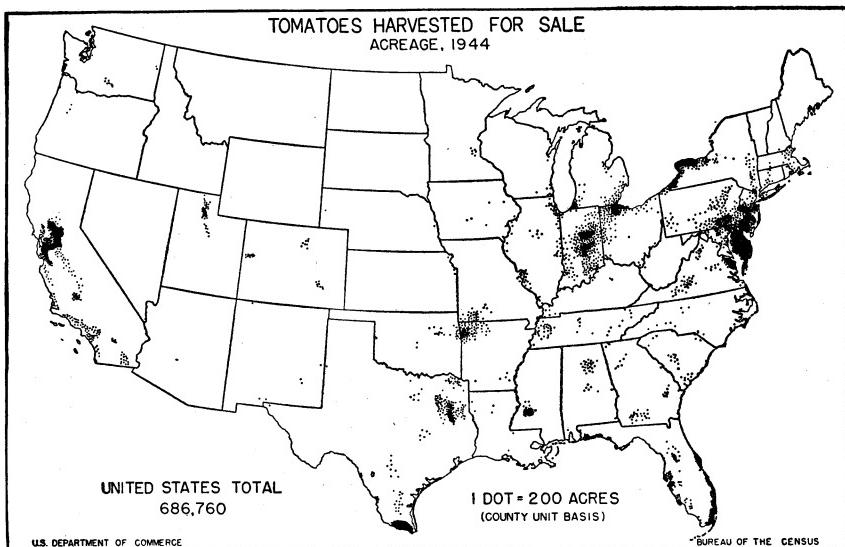


FIGURE 1.—Most of the fresh tomatoes for market are produced in Texas, California, Florida, Tennessee, Mississippi, Ohio, New York, Michigan, Indiana, Arkansas, Colorado, Louisiana, Utah, Oregon, Maryland, South Carolina, Washington, Virginia, North Carolina, and Georgia.

It was estimated that about half the crop of fresh tomatoes produced in the United States in 1947 was transported to market by motortruck. Motortruck shipments largely originate in important producing States other than those mentioned, which include New Jersey, New York, Illinois, Indiana, Ohio, Maryland, Michigan, Missouri, Pennsylvania, Virginia, South Carolina, and Arkansas. Shipments by motortruck, however, are by no means confined to States comparatively near the large market centers. The length of the haul has been gradually increasing. Recent unload reports for Chicago, New York City, Philadelphia, and other large northern cities, show that many motortruck shipments originate in Florida and other southern producing States. Likewise, during the late summer months, when local supplies are not sufficient to meet demand, some tomatoes are moved by motortruck from northern producing areas to Atlanta, Jacksonville, and other cities in the South.

Fortunately the varying climates in the United States enable consumers to enjoy fresh tomatoes every month of the year.

Florida is the principal source of supply in the United States for fresh market tomatoes during the late fall, the winter, and the spring months. Texas also produces some tomatoes for the late fall market but the bulk of the crop is marketed during May and June in competition with other late spring and early summer producing States. Considerable quantities of tomatoes from Cuba and Mexico also are imported during the winter and spring months. In addition, during this period, supplies are supplemented to some extent by production in greenhouses, principally in the East North Central, Middle Atlantic, and southern New England States. The principal Florida area devoted to the production of tomatoes extends north and south of Miami

in Indian River, Saint Lucie, Palm Beach, Broward, and Dade Counties. Fort Pierce, Vero Beach, Dania, Hollywood, Perrine, Peters, Princeton, Goulds, and Homestead are important shipping points. On the west coast of Florida there are important producing areas in Collier, Hillsborough, and Manatee Counties in which Everglades, North Ruskin, and Palmetto are well-known loading stations. There is also some production in the vicinity of Webster in Sumter County and Okeechobee in Okeechobee County.

During May and June most of the fresh tomatoes are supplied by the late spring group of States, in which Texas and Mississippi are the most important in volume of production, but some supplies also are shipped from Louisiana, Georgia, Florida, and South Carolina during this time. The lower Rio Grande Valley is the principal tomato-producing section in Texas. Edinburg, McAllen, Mercedes, Pharr, and Weslaco, in Hidalgo County; Brownsville, Harlingen, La Feria, and San Benito, in Cameron County; and Raymondville, in Willacy County, are heavy loading points in this area. More recently Laredo, in Webb County, and Eagle Pass in Maverick County have become quite important shipping centers. Other important producing areas in Texas include the Yoakum district, in Lavaca and De Witt Counties, and the east Texas district, in which Anderson, Bowie, Cherokee, Henderson, Panola, Shelby, Smith, and Van Zandt are the principal producing counties.

In Mississippi the tomato-producing industry is located to the south and southwest of Jackson in Copiah and Hinds Counties where Crystal Springs, Hazlehurst, Terry, and Utica are the leading shipping points.

In July supplies of fresh tomatoes come largely from the early summer producing States, which include Tennessee, Maryland, Missouri, Arkansas, North Carolina, Virginia, Delaware, the central district of California, southeastern Ohio, and southern Illinois. Tomato production in Tennessee is largely confined to Gibson and Crockett Counties, where Humboldt, Gibson, Milan, Medina, Trenton, and Bells are the chief loading points.

The Eastern Shore is the most important producing section in Maryland and Virginia, although there is scattered production elsewhere in these States. North Carolina shipments largely come from Bertie, Carteret, Scotland, and Washington Counties. The Marietta district in southeastern Ohio furnishes a considerable supply of fresh tomatoes during late June and early July. In southern Illinois tomatoes are grown in Union and Monroe Counties and mostly loaded at the towns of Waterloo, Anna, and Cobden.

In Missouri tomatoes are largely produced in Jefferson County near St. Louis and in the southwestern part of the State, principally in Barry, Christian, Jasper, Lawrence, McDonald, and Newton Counties. Production in Arkansas is largely confined to several counties in the extreme northwestern part of the State but there is scattered production elsewhere, particularly in a few of the southwestern counties—Hempstead, Howard, Sevier, and Nevada—and in some of the southeastern counties—Ashley, Bradley, and Drew.

Tomato shipments from California usually begin in May from the Imperial Valley and continue from other sections until December. Therefore, parts of the State are classed as early spring, early summer, and early fall. The comparatively important producing areas include Los Angeles, San Diego, and Ventura Counties, in the southern dis-

TABLE 1.—*Carlot shipments of tomatoes from principal producing States, calendar years 1938-47*¹

State	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	10-year average
Texas	Carlots 7, 232	Carlots 7, 468	Carlots 6, 546	Carlots 5, 773	Carlots 7, 883	Carlots 9, 050	Carlots 11, 998	Carlots 16, 254	Carlots 16, 417	Carlots 12, 632	Carlots 10, 125
California	4, 703	3, 653	3, 850	4, 808	4, 866	6, 321	5, 719	6, 358	7, 895	6, 690	5, 486
Florida	1, 185	8, 658	5, 689	3, 522	5, 329	4, 342	3, 939	5, 910	5, 781	2, 576	4, 693
Tennessee	2, 035	1, 082	1, 313	1, 001	846	551	750	1, 127	1, 159	689	1, 055
Mississippi	2, 863	1, 990	937	856	1, 217	1, 063	712	597	648	265	1, 115
Ohio	962	904	553	678	1, 058	187	383	863	1, 112	83	678
New York	875	492	163	159	336	572	288	640	205	162	389
Michigan	217	194	171	251	518	79	437	514	743	174	330
Indiana	769	790	354	449	738	152	671	350	354	87	471
Arkansas	424	194	233	207	236	181	241	314	464	322	282
Colorado	62	117	74	56	111	180	171	189	229	215	140
Louisiana	339	272	396	188	173	105	73	180	70	18	181
Utah	153	148	82	87	126	343	184	135	165	53	148
Oregon	72	107	67	68	71	60	73	123	179	138	96
Maryland	432	206	323	89	189	138	100	64	50	74	167
South Carolina	668	341	189	24	73	35	12	59	107	14	152
Washington	0	84	30	53	51	78	22	56	190	216	78
Virginia	46	39	23	39	27	28	22	44	1	23	29
North Carolina	145	70	153	44	27	6	7	7	14	0	47
Georgia	81	28	190	11	17	14	6	3	2	1	35

¹ Compiled from daily and monthly reports received by the Production and Marketing Administration from officials and local agents of common carriers throughout the country. Shipments as shown in carlots include those by boat reduced to carlot basis. Shipments by motortruck are not included.

trict, Kern, Merced, Santa Barbara, Contra Costa, Alameda, Monterey, and Santa Cruz Counties, in the central district, and the Sacramento section in the northern district. Important shipping centers in California include Los Angeles, Oxnard, Whittier, Watsonville Junction, Watsonville, Delano, Edison, Goleta, Santa Maria, Merced, San Leandro, Centerville, Brentwood, Sacramento, Walnut Grove, Carbona, and Tracy.

Liberal supplies of fresh tomatoes are usually furnished from mid-summer to frost by scattered production in a large number of late summer producing States, which include New Jersey, New York, Indiana, Michigan, Pennsylvania, Colorado, Utah, Oregon, Washington, Kentucky, and the northern parts of Illinois and Ohio. Rail shipments from most of these States are negligible as most of this production moves to market by motortruck.

TABLE 2.—*Monthly carlot shipments of tomatoes, 1938-47*¹

Year	Jan.	Feb.	Mar.	Apr.	May	June	July
	<i>Carlots</i>	<i>Carlots</i>	<i>Carlots</i>	<i>Carlots</i>	<i>Carlots</i>	<i>Carlots</i>	<i>Carlots</i>
1938-----	183	1,081	3,601	4,696	6 ² 250	8,108	2,190
1939-----	763	1,378	2,211	2,687	4,757	6,509	1,623
1940-----	463	32	4	443	4,077	7,794	3,333
1941-----	441	336	104	254	3,255	6,121	1,721
1942-----	458	584	487	744	4,922	6,358	2,081
1943-----	519	762	362	581	5,279	5,829	1,871
1944-----	593	702	1,727	1,477	6,412	5,268	1,951
1945-----	414	1,185	1,774	3,513	7,683	5,941	3,046
1946-----	194	786	1,479	3,287	8,027	7,107	2,812
1947-----	692	249	97	377	5,089	6,256	3,251

Year	Aug.	Sept.	Oct.	Nov.	Dec.	Total
	<i>Carlots</i>	<i>Carlots</i>	<i>Carlots</i>	<i>Carlots</i>	<i>Carlots</i>	<i>Carlots</i>
1938-----	1,875	3,772	2,235	897	347	35,235
1939-----	1,849	2,958	1,844	1,070	789	28,438
1940-----	846	1,965	1,648	1,021	621	22,247
1941-----	710	2,819	2,087	1,189	529	19,566
1942-----	1,153	3,820	2,309	1,577	730	² 25,223
1943-----	1,516	2,998	3,048	1,713	798	³ 25,276
1944-----	1,597	3,769	3,014	1,017	465	⁴ 27,992
1945-----	1,244	4,126	3,417	1,779	1,046	⁵ 35,168
1946-----	1,249	4,404	4,218	2,225	838	⁶ 36,626
1947-----	1,296	2,919	2,737	1,647	912	⁷ 25,522

¹ Compiled from daily and monthly reports received by the Production and Marketing Administration from officials and local agents of common carriers throughout the country. Shipments as shown in carlots include those by boat reduced to carlot basis. Shipments by motortruck are not included.

² Includes 3,496 cars for manufacture.

³ Includes 1,742 cars for manufacture.

⁴ Includes 2,463 cars for manufacture.

⁵ Includes 2,269 cars for manufacture.

⁶ Includes 2,162 cars for manufacture.

⁷ Includes 1,135 cars for manufacture.

STAKING AND PRUNING AS RELATED TO MARKET QUALITY

Two general systems of handling the plants are practiced in the various tomato-producing sections of the country. In one, the plant is allowed to develop naturally, spreading out and falling upon the ground as it develops. This is the usual practice throughout most of the producing sections in California, Florida, New Jersey, New York, Utah, Colorado, Washington, Oklahoma, Arkansas, Kentucky, Michigan, Indiana, Alabama, South Carolina, and in practically all producing areas in Texas except the Yoakum district. In the other system, the plant is allowed to develop one, two, or three stems, the number depending on the grower's estimate of the soil fertility. The stems are loosely tied to a stake driven beside each plant. As the plant grows, additional tyings are made and all side branches are cut or pinched out as they appear at the base of the plant or in the axils of the leaves.

Staking is still the prevailing practice in most of the tomato-producing areas of Mississippi, Tennessee, Louisiana, and the Marietta district in southeastern Ohio. Some growers in Tulare, Fresno, Merced, and Stanislaus Counties of California, the Palmetto and Manatee district of Florida, the Yoakum district in Texas, parts of Pennsylvania, Alabama, and southern Illinois also stake all or a part of their plants.

Some growers in the Northeastern States follow a practice known as "leaf pruning." The purpose is to stimulate the early formation of the branches and the setting of a large number of fruit clusters. All the leaf except the inner two lobes or segments is pruned away when the plants are from 6 to 9 inches in height. After the branches have started no further pruning is practiced and the plants are left to grow and spread on the ground naturally.

Growers of greenhouse tomatoes usually follow the single-stem system of pruning and training tomato plants, although some growers train the vines to two or three stems.² Any shoots arising from the leaf axils are removed to throw all of the energy of the plant to the main stem. The plants are supported either by heavy twine running from the base of the plant to an overhead attachment or by stakes driven by the side of each plant. Soft twine is used to tie the plants to the supporting twine or stake.

Some tomatoes on the first-formed or lowest clusters are often rough, ridged, or ill-shaped and are unsuitable for slicing purposes because of the large proportion of the fruit wasted in preparing it for use. Likewise, tomatoes produced on the top clusters are often not satisfactory from the market standpoint, because of small size and lack of firmness. Tomatoes in the top clusters are often sunburned, or they show subnormal color when ripe because of the depletion of plant foliage and weakened vitality of the vine during the latter part of the season. Rough or ill-shaped specimens from bottom clusters and thin-walled, unattractive tomatoes from top clusters are of inferior quality from the standpoint of appearance and shipping quality and should be sorted out from normal-shaped, firm, and meaty fruit before being packed for distant shipment.

² Farmers' Bulletin 1431, Greenhouse Tomatoes.

COMMERCIAL VARIETIES

The choice of varieties is an important factor in successful tomato production. In the old established tomato-growing sections the varieties that are best adapted to each particular section have been well demonstrated. Growers should therefore confine production to those varieties which are adapted to their section and possess the most desirable market qualities. Those varieties which produce fruit that is medium in size, smooth, and well-shaped will prove the most satisfactory from the market standpoint. Tomatoes larger than $3\frac{1}{4}$ inches in diameter are often badly ridged over the shoulders or are otherwise misshapen and will seldom command as high a price as those that range from $2\frac{1}{4}$ to $3\frac{1}{4}$ inches in diameter.

It is important that varieties should not be mixed, especially those that have different shades of red color when ripened. In some sections where several main-crop varieties are produced there is a tendency to disregard variety when packing tomatoes for shipment. These sections ordinarily ship their stock in the green stage, at which time difference in color is not apparent. After such a lot ripens, however, a mixture of yellow-red and purplish-red varieties in the same container is very noticeable and the unattractive appearance is likely to be reflected in the selling price. A mixture of varieties is not so objectionable if the stock is similarly shaped and develops the same shade of color when ripened.

Many varieties of tomatoes are grown in the United States but only a few are commercially important. Varieties which are popular today may soon be discarded for supposedly better varieties. Experiment stations and seedsmen are continually breeding new varieties and selecting improved strains of existing varieties. As a result some varieties which were extensively grown a few years ago are either not produced today or have been relegated to a position of minor importance.

By far the most popular variety now grown both for fresh market and for processing in the Eastern and Southern States is the Rutgers. This tomato, developed at the New Jersey Agricultural Experiment Station by selections from a cross made in 1928 between Marglobe and J. T. D. varieties, was officially named and released to seedsmen and tomato growers for commercial production in 1934. Since that time it has become the most extensively grown variety in Florida, Texas, Alabama, Mississippi, Kentucky, Tennessee, Arkansas, New Jersey, Michigan, and Illinois, and is second only to Marglobe in a few other States, including Louisiana, South Carolina, and New York. It is also popular in Pennsylvania and Colorado.

The Rutgers is characterized by having large plants with thick stems and an abundance of vigorous foliage to protect fruits from sunburn and sunscald. Fruits are medium to large, similar in shape to those of Marglobe, have thick outer walls with small seed cavities, and firm, dark-red flesh when fully ripe.

Marglobe, the leading variety grown 10 years ago in most of the Southern, Eastern, and North Central States, is still produced to some extent and probably ranks first in importance in South Carolina, Louisiana, New York, and Utah. It is a prolific producer, is disease

resistant, and the fruit is generally well-shaped, firm, and meaty and possesses excellent shipping qualities.

Some of the older important varieties still grown, particularly in northern producing States, are Stokesdale, John Baer, Pritchard, Baltimore, Bonny Best, and Break O'Day. Also some relatively new varieties grown which may become more popular in these States are Pan America, Garden State, and Valiant. Other varieties which assume considerable importance on the fresh market are Red Globe, sometimes called Grothens or Grothens Globe, mostly grown on the east coast of Florida, and Gulf State Market, produced in Texas and Florida.

Varietal production also has undergone considerable change in the Western States during recent years. A few years ago Marglobe, Martin Stone, and Jack of Hearts were the leading shipping varieties in California. These varieties are of minor importance today and have been largely displaced by the Pearson, named in 1937 for O. H. Pearson, formerly of the Agricultural Experiment Station of the University of California, who originated it by crossing Cal 55 (a selection of San Jose Canner) and Fargo, an early maturing variety developed by A. F. Yeager of the North Dakota Agricultural Experiment Station. In plant habit, the Pearson differs from standard varieties in being "self-pruning" or "self-topping," which means that the stems terminate in a blossom cluster as opposed to the perennial habit of growth of standard varieties. Fruit of the Pearson is of a slightly flattened globe shape, a little larger than the fruit of the Marglobe, is smooth, and has a tough skin, heavy walls, and numerous cells. It is deep red when ripe, a quality which has helped to make the variety also the leading one for processing in California. In addition to being produced so extensively in California, it is also grown in Colorado, Utah, and the Northwestern States. Other varieties grown to a lesser extent for market in the Western States are Stone, Earliana, Pritchard, Baltimore, Bonny Best, and some yet unnamed strains sponsored by seedsmen in California under the numbers 133-6 and 498.

HARVESTING

Tomatoes grown under the best of conditions are highly perishable and should be harvested and packed as rapidly as consistent with careful handling practices. In the green stage they seem firm and will apparently stand a considerable amount of rough handling, but the damage becomes apparent in the markets after the fruit has ripened. Abrasions or bruises that are scarcely noticeable on a mature-green fruit are likely to appear as dark-brown or black unsightly spots at the market. Bruises and mechanically injured areas also provide an easy entrance for disease organisms, and every effort should be directed toward lessening the opportunity for such infection. In many sections harvesting is done by laborers who are indifferent to these points. Even some well-informed growers and shippers often fail to give proper attention to the maintenance of a high-quality product. In their effort to handle a large acreage they overlook the fact that profits often depend more upon quality than upon quantity.

TIME OF PICKING

The proper stage at which tomatoes should be picked depends to a large extent on the distance from the markets. Three definite stages for marketing are recognized commercially—mature-green, pink, and ripe. Tomatoes reach a stage of maturity on the vine that will insure ripening several days before any pink or red develops on the surface. Fruit that is to be shipped long distances to market therefore is usually picked in the mature-green stage and shipped with or without refrigeration, depending upon the season of the year and weather conditions through which it is expected to pass.

Mature-green tomatoes or "green wraps," as they are sometimes called, comprise the bulk of the shipments from Florida, Texas, Mississippi, Tennessee, California, South Carolina, Louisiana, Colorado, Utah, and other southern and western producing States. At this stage the tomato is almost fully grown and the interior ripening processes are well under way. The characteristic red color usually develops on some of the tomatoes during the transit period.

A large percentage of green-wrap stock arrives in the markets without a trace of red color, and even when held in ripening rooms for several days at a temperature of from 70° to 75° F. many tomatoes do not develop normal color. Usually the fault lies with the pickers who, in depending on size as the principal indication of maturity, pick the fruit before it is sufficiently developed. Also there is a tendency upon the part of many shippers at the beginning of the season to ship green tomatoes before they are mature, hoping they will get top prices before tomatoes become more plentiful. Often the reverse is true and they fail to get repeat orders from a dissatisfied receiver who may have been put to great inconvenience in ripening and disposing of the shipment.

According to the requirements of the United States standards for fresh tomatoes, a tomato is considered mature when the seed cavities have developed a jellylike or gluelike consistency and the seeds are well developed. In the practical test a sharp knife should be used and the tomato cut crosswise of the seed cells. If the pulp that surrounds the seeds has become jellylike and the seeds give way before the edge of the knife and are not cut in slicing, the tomato is considered to be mature enough to be shipped. For some varieties the presence of light color or whitish area on the blossom end of the fruit is considered a fairly reliable index of picking maturity. The size of tomato fruits is not a proper guide to the maturity, as it is the age that determines development.

The careful foreman, before issuing instructions to the picking crew, usually selects a number of tomatoes and after slicing them to determine the relation of the external characteristics to the stage of maturity, bases his instructions to the pickers on the rule that seems to apply best. It is difficult to lay down any directions that will be followed closely by the pickers, as their usual tendency is to pick all fruit that has attained a certain size. However, through close supervision and proper cooperation between the foreman in charge of the pickers and the foreman at the packing house, a large proportion of the extremely immature stock which is now received in the markets only to

shriveled before attaining normal color might be left on the vines until fully developed.

At the beginning of the season vines should be picked at least once a week and after the season is well under way they should be gone over at least twice a week or preferably every other day in hot weather.

Tomatoes are picked in the pink (sometimes referred to as "turning") and ripe stages in those sections that are comparatively near to the markets. The bulk of the supplies from New Jersey, Michigan, Indiana, Pennsylvania, and Ohio, and a large part of those from New York, Illinois, Virginia, Maryland, and Washington, as well as those from other North Central, Eastern, and Northeastern States, are marketed in these stages. Sending tomatoes to market by motortruck has increased the volume being marketed in these stages. Even though produced relatively near the markets, tomatoes formerly shipped by rail often did not reach consuming trade channels until 3 or 4 days after picking. With the advent of the motortruck as a means of transportation, tomatoes are now moved several hundred miles overnight and are offered to the consuming trade the following morning.

Tomatoes in the pink stage will naturally hold up longer than those picked in the ripe stage. The term "pink" is applied to tomatoes with red or pink color varying from a trace at the blossom end to a considerable amount of the surface covered. The term "ripe" indicates that most of the surface is covered with pink or red. However, the tomatoes should be firm and should show no indication of softness. It is generally conceded that tomatoes picked in the pink and ripe stages have a better flavor than those picked in the mature-green stage.

Tomatoes from fields which are to be marketed in the pink and ripe stages should be picked every day or two when the ripening season is well under way. Otherwise the chances of getting soft and overripe fruit into the pack are very great.

PICKING UTENSILS

Picking utensils of many varieties are used in the various tomato-producing sections. Galvanized-iron buckets and $\frac{1}{2}$ -bushel round stave baskets equipped with wide bails for the comfort of the pickers are among the most satisfactory picking utensils now in use. Various sizes of climax or splint baskets are popular picking containers in some sections, notably in Ohio and New York. Larger types of picking utensils are generally undesirable because pickers have a tendency to set them on the ground and toss the fruit from a considerable distance in order to avoid carrying them about from vine to vine. In New Jersey, Pennsylvania, Maryland, Virginia, and some of the other Middle Atlantic, South Atlantic, and North Central States the $\frac{5}{8}$ -bushel hamper is often provided with a handle and used for picking. Unless lined with some protective material, this is not regarded as a very satisfactory picking container because of the risk of injury to the tomatoes from wire staples which often protrude on the inside of the container. Also some tomatoes in the lower part of the hamper may become bruised or crushed.

Regardless of the shape and size of picking utensils used, the interiors should be inspected carefully and all sharp edges, nail points, and rough surfaces should be smoothed off. Some of the more progressive growers in California and other States have adopted the

practice of placing corrugated paper pads or burlap in the bottoms of picking containers to avoid bruising the fruit in handling and to prevent the tomatoes from rubbing on any dirt or sand that may accumulate in the bottom of the containers. Every effort should be directed toward careful handling, for the small skin breaks, bruises, and abrasions made by sharp or rough edges, although little noticed at the time of packing, may afford an entrance for disease organisms which develop rots or may provide the basis for unsightly scars on the ripened fruit.

Various sizes and types of field crates, baskets, and boxes are in use throughout producing States. A few types are shown in figure 2. In Florida, boxes of about 1-bushel capacity are the most widely used field containers and citrus boxes and $\frac{1}{2}$ -bushel and bushel baskets are used



PMA 15617

FIGURE 2.—Three popular types of field containers: Left, the $\frac{5}{8}$ -bushel hamper, used extensively in many of the Eastern States; center, the bushel box, used widely in a number of Southern and Middle Western States; and right, the round-bottom $\frac{1}{2}$ -bushel basket, used to some extent in Florida, Texas, and a few other States.

to some extent. Boxes or crates holding about a bushel of tomatoes but with varying dimensions are used in a number of other States, including Alabama, South Carolina, Mississippi, Tennessee, Oklahoma, Arkansas, Kentucky, Colorado, Utah, and possibly some other States. Typical inside dimensions of these boxes are those of one used in Tennessee, which is about 10 inches deep by 13 inches wide by $24\frac{1}{2}$ inches long.

Some New York growers use a larger field box, approximately 18 inches by 18 inches by 40 inches, as well as tub-type bushel baskets and bushel slatted crates. In several Eastern States, including Maryland, Virginia, Pennsylvania, and New Jersey, growers for the most part use $\frac{5}{8}$ -bushel hampers as picking containers as well as for transporting tomatoes to packing sheds and even to markets by motortruck. In the lower Rio Grande Valley of Texas, growers who haul their own tomatoes utilize slatted crates with inside dimensions $8\frac{1}{2}$ inches by

13 inches by 22 inches. Some shippers furnish crews for harvesting, in which case they use their own shed boxes, which are either 11½ inches by 14 inches by 24½ inches or 9½ inches by 14 inches by 21¾ inches. In the east Texas district most of the tomatoes are picked and hauled in round-bottom bushel baskets.

Most farmers in the Yoakum district dump their tomatoes directly into pick-up trucks or small trailers and haul the tomatoes in bulk to the packing sheds. Lug boxes of various dimensions are mostly used in California for transporting tomatoes from fields to packing houses. Typical dimensions of some of the lugs used are 7½ inches by 14 inches by 22 inches, 8½ inches by 14 inches by 17½ inches, 6 inches by 15 inches by 21½ inches. Many growers also use the standard lug box as a shipping container which without cleats is 5¾ inches by 13½ inches by 16⅓ inches inside. In Kern County, four-wheeled trailers are used for bulk transportation of tomatoes from fields to packing sheds. Tomatoes grown in Washington are ordinarily hauled either in lug boxes about 6¾ inches by 14 inches by 20½ inches or in standard apple boxes 10½ inches by 11½ inches by 18 inches.

Recent years have witnessed the passing of some of the larger unwieldly types of field containers formerly used in some States. Field crates and boxes should preferably be light in weight but should be durable and should be equipped with cleats across the top at each end to prevent bruising the fruit in stacking. If possible they should be made from dressed lumber as tomatoes receive more or less bruising and abrasion when hauled in containers made from unplanned material. Boxes should be provided with handholes to facilitate handling.

PICKING

The grower and members of his family are usually able to pick the tomato crop when the acreage is small, but the producer of a large acreage must hire crews of pickers to work under his or his foreman's direction. In many of the more important producing States, particularly in the South and West, much of the labor employed in picking tomatoes is migratory. Many growers pay a uniform daily wage, whereas others prefer to pay on the basis of the quantity picked. Both methods have advantages and disadvantages. Under the set daily wage system pickers are likely to follow instructions more carefully and to pick only those tomatoes that have reached the right stage of maturity. Pickers paid on the basis of the quantity picked are likely to sacrifice quality for quantity unless they are closely supervised.

In picking, the tomato should be grasped in the hand with the thumb or forefinger pressing against the stem, and should be separated from the vine by a half turn or twist. Tomatoes are easily separated from the vine even at the mature-green stage, as a layer of hard-walled or corky cells develops at the union of the stem and the fruit. This layer forms on the outer rim of the stem and extends inward; after the tomato is picked this layer appears as a brownish ring in the stem eye. In sorting operations the width of this ring is sometimes used as an indication of the maturity of green tomatoes, and specimens that show a very narrow brownish ring or have a greenish-white cast in the entire stem-eye area are discarded as being immature.

Preferably one row, or two at the most, should be assigned to each picker, so that picking containers will be within convenient reach.

Care should be exercised to prevent bruising the fruit in transferring it from the picking utensil to the field container. In dumping, the picking container should be so tilted as to permit the tomatoes to roll gently into the field container.

Short rows and a generous distribution of field containers at the roadway or ends of the rows increase the daily output by decreasing the distance the picker must carry his filled basket. Cross roadways should be made at regular intervals if the rows are exceptionally long or, if this is impracticable and the vines are staked, the field crates may be placed on a long sled and drawn between the rows. If the packing shed is adjacent to the field, the filled containers are hauled directly to that point. Otherwise they are left at the end of the rows and placed on a wagon or truck for hauling to the packing house.

The hauling of tomatoes in bulk from fields to packing houses in beds of trucks or trailers, as is done in some districts of Texas and California, is not regarded as good practice. It may be labor saving but tomatoes so handled are subject to more or less rough treatment in loading and unloading. The bruising that results, although it may escape the scrutiny of the sorters, seriously injures the appearance of the tomatoes after they have ripened and final returns for the tomatoes may offset any labor-saving costs in this method of handling.

Growers of greenhouse tomatoes follow a slightly different practice in picking tomatoes than do growers of field-grown fruit. Instead of twisting the tomato from the vine, most of the greenhouse growers clip the stem just above the calyx, thus leaving the calyx and a small portion of the stem attached to the tomato. This practice is followed in order that the tradesmen and consumers may be able to distinguish greenhouse-grown from field-grown fruit. Ripe greenhouse-grown tomatoes with the stems and calyxes attached present an attractive appearance, but unless great care is used in handling and packing, some tomatoes may be punctured by the stems of other tomatoes.

FARM PACKING

Packing of fresh tomatoes on the farm by the growers is gradually giving away to packing in centralized packing houses by experienced sorters and packers. Farm packing is now largely confined to producing areas in the North Central and Eastern States where the tomatoes are for the most part hauled by truck and marketed in the pink and ripe stages. In the Marietta district in southeastern Ohio, however, most of the fresh tomatoes are prepared for market in central packing houses.

Although improvement has been noted in the quality of farmers' packs in recent years, there is often a wide variation in the quality of an individual grower's lots. In many cases sizing is irregular and the arrangement of the fruit in the packages is frequently uneven, loose, and unattractive.

Sorting and packing equipment on small farms is often very crude. Operations are frequently carried on in the shade of a tree or under a temporary roof made of canvas or boards supported at the corners by poles. Even though the shelter provided is not weatherproof there is no excuse for not providing for careful handling of the tomatoes.

A waist-high packing bin about 30 inches wide, 8 inches deep, and several feet long with a wire-net bottom covered with canvas or burlap should be provided. If the bottom of the bin is made of boards it should be well padded with burlap or some other soft material. A packing bench should be constructed along one side of the bin.

CENTRAL PACKING HOUSES

A marked improvement has been evident during recent years in the quality of fresh tomatoes offered for sale in the markets. Much of this improvement can be attributed to the increased volume that is sorted and packed in central packing houses by experienced sorters and packers instead of being packed at the farm by the grower and members of his family. The bulk of the green-wrapped stock from Florida, Mississippi, Texas, California, and Tennessee, as well as that from the less important producing States, is now prepared for shipment in centralized packing houses.

Central packing houses are usually operated by the shipper but in some instances they are operated by cooperative associations or individual growers who control large acreages. Local buyers either purchase the unpacked tomatoes in field containers or arrange with the grower to act as selling agent and to market the crop on a consignment basis after making a fixed charge per package for sorting and packing. The central packing houses are largely responsible for placing a fairly well-standardized product on the markets. Usually their operations are on a scale sufficiently large to permit a division of labor and adequate supervision. The managers are in a position to maintain experienced sorters and packers, who are essential to the packing of a uniform and high-quality product.

LOCATION

In producing sections where the crop is to be shipped by rail it is preferable that the packing house be located alongside the track or spur track. Many tomato packing houses are so located, in or near small towns and villages. Packed fruit can be loaded directly into the cars and packing-house employees need not be transported to the packing houses.

Locating the packing house on a railroad siding is not always feasible if the producing section is located some distance from the railroad. Under such conditions it may be best to locate the packing house close to the fields and transport the packed fruit by truck to the railroad. In transporting there is likely to be less injury to fruit packed in containers for shipment than to unpacked fruit in field crates.

CONSTRUCTION

Most of the tomato packing houses are rectangular-shaped frame or galvanized-iron buildings of various dimensions, usually from 35 to 50 feet wide and 60 to 150 feet long (fig. 3). Some are one story and others are two stories high. The penthouse type of construction is often employed in the two-story buildings. In the two-story houses the upper story or loft is generally used for the construction and storage of lug boxes, which are supplied to the packers on the lower

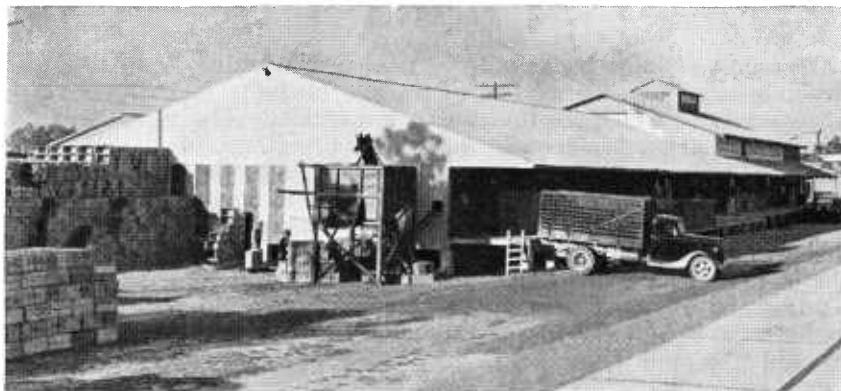


FIGURE 3.—Unloading mature-green tomatoes from a truck at a typical Florida vegetable packing house. After growers unload filled boxes they pick up empties, as shown stacked at the rear of the house.

floor by means of slides or chutes. The lower floor should preferably be constructed at approximately the same height as a truck or wagon bed, or the floors of refrigerator cars if the house is on a railroad siding. In many instances covered platforms materially enlarge the protected area for storage purposes but have the disadvantage of shutting off the light from the interior of the house.

Regardless of size or capacity the well-constructed packing house should provide for adequate ventilation, good light, and ample storage space. Good ventilation is essential because most tomatoes are packed during warm weather. If the packing space is not enclosed or if large sliding doors and windows are provided, the problem of ventilation is relatively simple. Circulation of air may be increased by providing slatted floors, but as they are not easy to truck over, a better arrangement is to provide solid floors in the trucking alleys and slatted floors over the storage space.

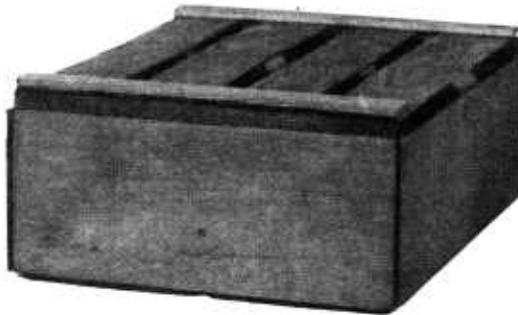
An abundance of light is needed for the sorting operations, because such defects as immaturity, worm injury, and certain types of disease do not show conspicuously on the green or red surface of the tomato when the fruit is in shadow. The method of providing illumination depends on the interior arrangement of the house. Where the sorting and packing operations are performed along the side or end of the building, sliding doors or high windows may be placed along the side walls, but with this arrangement some of the workers are likely to stand in their own light. Some packing-house managers prefer to carry on the sorting and packing operations in the central part of the house. This is generally satisfactory if this section of the house is amply lighted by artificial light or if large skylights or windows in a penthouse type of roof are provided. In the latter type of construction the penthouse structure should be at least 10 feet in height. In houses provided with lofts for the storage of crate material and lug boxes, shafts or walls are sometimes used to admit light and concentrate it directly over the sorting tables. The interior of these shafts should be painted white to intensify the illumination.

PACKAGES

The most suitable package to be used in marketing fresh tomatoes depends largely on the method of transportation to market, the stage of maturity at which the tomatoes are marketed, relative costs of the packages, market preferences, and the kind of labor available. The lug box has become the most popular package for carload shipments of green-wrap stock. Other packages of minor importance from the national standpoint, but of considerable importance in local producing districts, are the 12-quart climax basket, the western peach box, the $\frac{5}{8}$ -bushel hamper, the $\frac{1}{2}$ - and 1-bushel round stave baskets, the 8-, 12-, and 16-quart corrugated fiberboard and square-braid splint baskets, the 8-, 12-, and 16-quart diamond-weave splint baskets and the 25- and 50-pound boxes.

THE LUG BOX

The lug box shown in figure 4 has practically displaced all other types of packages for the shipment of green-wrap tomatoes in carload lots. The bulk of the shipments of mature-green tomatoes from California, Florida, Texas, Mississippi, Tennessee, Utah, Colorado, Ken-



PMA 24481

FIGURE 4.—The lug box now used almost exclusively for carlot shipments of green-wrap tomatoes.

tucky, Arkansas, Oklahoma, Alabama, South Carolina, Louisiana, New York, Oregon, and Washington now arrive in the markets in this package. Its standard dimensions are $13\frac{1}{2}$ inches wide by $16\frac{1}{8}$ inches long by $5\frac{3}{4}$ inches deep, inside measurements. A cleat $1\frac{1}{16}$ of an inch thick is used at each end of the lug to protect the tomatoes from pressure by the lid. Some shippers prefer to use narrow cleats of the same widths as the end pieces of the lug; others use cleats wider than the end pieces. Wide cleats are often rounded at the inside lower corner to prevent cutting and bruising of the fruit. Although the above dimensions of the package and cleat are given as standard, lugs of slightly different dimensions are sometimes used in some sections.

When the lug is substantially constructed, the rectangular and regular shape permits easy loading in the cars. The lug is designed to hold three layers of medium- or large-sized tomatoes which weigh about 30 pounds net.

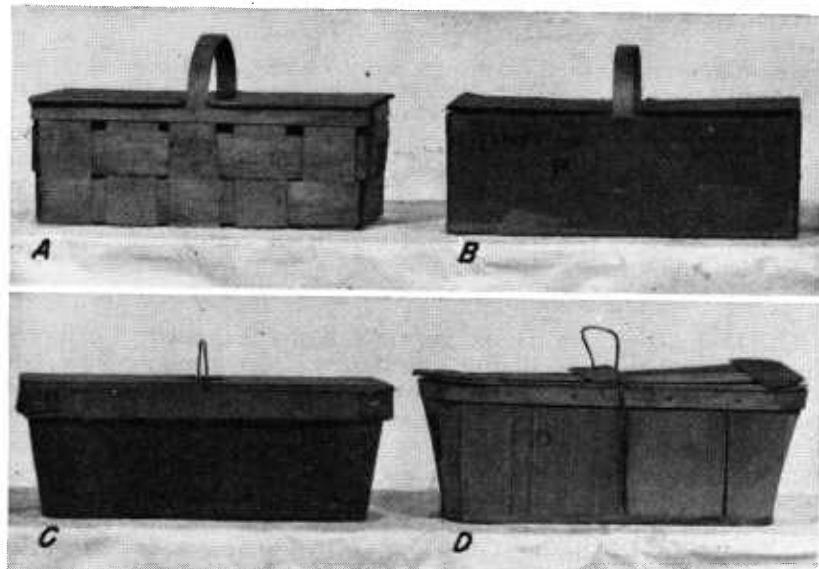
The use of the lug has encouraged more careful sorting and sizing of the fruit than is commonly practiced when the fruit is packed with-

out any order of arrangement. Each tomato is handled separately by the packers. The definite arrangement of the fruit within the lug contributes to its attractiveness and minimizes the danger of bruising.

The lug pack is more expensive than most other types because the services of experienced packers are necessary to insure properly packed lugs. General overhead for packing is also higher because this type of pack is prepared almost exclusively in central packing houses. Considerable volume is essential to insure profitable operation of the packing house where the lug pack is employed.

FIBERBOARD AND SPLINT BASKETS

The use of fiberboard and splint baskets with handles over the top (fig. 5) as containers for shipments of pink and ripe tomatoes to

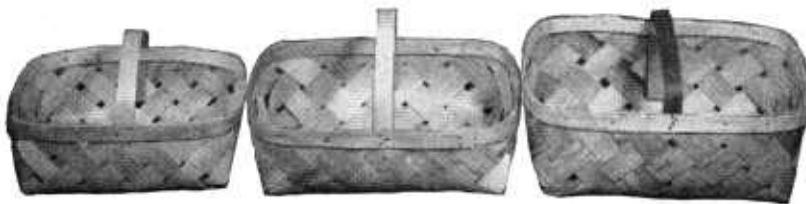


PMA 15818

FIGURE 5.—Types of overhandle baskets used extensively for marketing pink and ripe tomatoes in the East North Central States: (A) square-braid splint basket; (B) upright-type fiberboard basket; (C) nesting-type fiberboard basket; (D) climax basket. The square-braid splint and fiberboard baskets are made in standard 8-, 12-, and 16-quart sizes, the 8-quart size being the most popular. Climax baskets used for tomatoes are of standard 12-quart capacity.

market has been steadily increasing for a number of years. Greenhouse growers, particularly in the East North Central States, were the first to popularize the square-braid splint basket of 8-quart capacity many years ago. A little later they began to use an overhandle fiberboard basket of about the same dimensions. Use of these packages has gradually extended to field-grown fruit. In Ohio the bulk of both hothouse- and field-grown stock now moves to market in the 8-quart fiberboard basket. More recently fiberboard baskets of 12- and 16-quart capacities have been used to some extent in the East North Central States as containers for tomatoes.

Market baskets also have been popular containers for local shipments of tomatoes as well as for some other products in some of the Southern States. Baskets generally used for tomatoes are 12- or 16-quart diamond-weave splint baskets with overhandles, although some 8-quart baskets also are used (fig. 6). Pink and ripe stock is generally packed in these containers, which are transported to market mostly by motortruck.



PMA 15131

FIGURE 6.—Diamond-weave, overhandle splint baskets of standard 8-, 12-, and 16-quart capacities are used to some extent for marketing tomatoes locally in some Southern States. The 12-quart size is the most popular one.

Because of their small size and convenient handles these various types of market baskets are well adapted to selling tomatoes to consumers without disturbing the contents. The fiberboard baskets also lend themselves to the stamping of brands and other information in attractive colors.

THE 12-QUART CLIMAX BASKET

The 12-quart climax basket shown in figure 5 is used in several of the Northern States, including New Jersey, Pennsylvania, New York, Michigan, and Indiana. The tomatoes marketed in this container are usually picked in the pink or ripe stages. The package is readily prepared by inexperienced packers and is a convenient and popular size for sales in the original package direct to consumers. Although the tomatoes are protected by a slatted cover, the packages must be handled carefully to minimize damage to the contents. As the baskets are somewhat flexible, bruising and cutting may result from undue pressure or rough handling. Most of the tomatoes packed in this type of container are transported to market by motortruck.

THE WESTERN PEACH BOX

The western peach box is used to some extent in Washington and Oregon as a container for pink and ripe tomatoes packed for nearby markets. This container, which is $11\frac{1}{2}$ inches wide, 16 inches long, and $4\frac{1}{2}$ inches deep, is strongly built and convenient to handle.

THE $\frac{5}{8}$ -BUSHEL HAMPER

The $\frac{5}{8}$ -bushel hamper, in addition to being used extensively throughout the Eastern and East North Central States as a picking container and for transporting tomatoes to canneries, is commonly used for carrying pink or ripe tomatoes to market by motortruck, particularly from points in Pennsylvania, Maryland, Virginia, and New Jersey to nearby markets (fig. 2). This hamper is regarded as an unsatisfactory shipping container because tomatoes in it are subject to more or less mechanical injury and bruising in hauling and

handling. Care must be used in filling the hamper because some tomatoes are sure to be crushed if the package is overfilled.

ROUND STAVE BASKETS

Round stave baskets usually of $\frac{1}{2}$ - or 1-bushel capacity are used to some extent as containers for transporting pink or ripe tomatoes to local markets in the Eastern and East North Central States (fig. 2). They have the same disadvantage as other packages of considerable depth in that the weight of the fruit may crush some of the ripe tomatoes in the bottom of the packages.

THE FOUR-BASKET STRAIGHT-SIDED CRATE

Use of the four-basket straight-sided crate for early shipment of tomatoes in some sections of California has declined in recent years but this crate is still used for some shipments, particularly from the Coachella and Imperial Valleys. It holds four square till baskets containing 3 quarts, or approximately 5 pounds each.

THE 25- AND 50-POUND BOXES

Containers that have recently come into use include the 25- and 50-pound wooden boxes used in Atlanta, Ga., for repacking tomatoes for distribution to wholesale and retail outlets in Atlanta and smaller towns and cities in the surrounding territory. Most of the tomatoes received in Atlanta are repacked in these containers before being distributed. Much of the stock from nearby areas is delivered to the repackers in field boxes by motortruck. During off seasons many rail receipts of tomatoes from more distant States, packed in lug boxes, are repacked. The 25-pound box is 9 inches wide, 16 inches long, and 8 inches deep, and the 50-pound box is $10\frac{1}{2}$ inches wide, $20\frac{1}{2}$ inches long, and 10 inches deep. Paperboard dividers are used between each layer of fruit to prevent bruising and mashing.

PACKING-HOUSE EQUIPMENT

Not many years ago tomatoes were generally sorted and sized by hand and the important pieces of equipment in packing houses were the packing and sorting bins. Today the up-to-date packing house presents an entirely different appearance, with the addition of several machines and labor-saving devices arranged in a continuous line and designed to handle a large volume of tomatoes at a minimum of cost.

In most of the more important producing States that ship mature-green stock, it has become the general practice for shippers to wash tomatoes before packing them for shipment. This has resulted in the installation of washing and drying machines in packing houses. Many shippers in these States also have installed waxing machines which apply a thin coating of wax over the entire surface of the fruit for the purpose of preventing excessive shriveling.

Sorting from field containers or sorting bins in many States has been outmoded by sorting from roller-conveyor units or moving belts, where the sorters standing on either side remove defective tomatoes and separate the remainder into various grades. Sizing entirely by hand is no longer practiced by many in States that ship mature-green

tomatoes. Most shippers in these States have installed mechanical sizing machines in their packing lines to divide the tomatoes into at least four different size classifications. Another labor saver found in many of the larger packing houses is an electrically operated lidding machine which does away with hand nailing of lids.

Some question whether or not the recent widespread installation of mechanized equipment in tomato packing houses has resulted in sending better quality tomatoes to market. Tomatoes which run the gauntlet over a long line of roller conveyors and through various machines are subject to more or less bruising and rubbing. The injury may appear very minor or may not even be noticed at the time of packing, but may well be the source of infection by disease organisms or may cause discoloration, which will make a tomato worthless on arrival in the markets. On the contrary, others argue that tomatoes that are handled carefully, sorted and sized by hand, and packed from well-padded bins directly into containers for shipment, as is still the practice in many sections, receive considerably fewer bruises and abrasions than tomatoes that are passed over the mechanized equipment of the modern packing house.

In the installation of packing-house equipment, care should be taken to see that each unit is properly fitted in the line, in order to minimize mechanical injury to tomatoes. Any projections or rough edges should be padded with pieces of composition or rubber belting or similar material. Attention to such details often pays big dividends in preventing injury to tomatoes.

WASHING AND WAXING EQUIPMENT

During rainy periods, soil is often splashed on tomatoes. The sandy particles adhering to the surface of the fruit cause mechanical injury in the form of sand scarring if the tomatoes are handled much without being washed. For this reason and to improve their appearance it is almost necessary to wash them before they are packed. Also the tomatoes on the tops of containers become more or less coated with dust during transportation from the fields to packing houses; this likewise injures their appearance. As a result of these conditions many packing-house operators now consider the washing machine necessary equipment and all tomatoes handled through their packing houses are washed. In Florida, Texas, California, and Tennessee most of the crop is now washed before packing for shipment. A large part of the crop in some of the smaller producing States which ship green-wrap tomatoes is also washed.

When tomatoes are washed the washer generally is the first machine installed in the line. Usually there is a hopper at the head of the machine into which tomatoes from the field containers are poured. From the hopper the tomatoes are picked up by a roller conveyor which continues through the washer. These machines are not standardized but usually consist of a tank covered with a hood which is filled with water. Others simply contain a number of spray nozzles which spray the tomatoes as they pass along on the rollers (fig. 7). In the types of machines in which the tomatoes are submerged in a bath, various trade-named washing solutions are generally used. Some shippers give the tomatoes a warm bath with a temperature of about 110° F. to which a borax-soap solution has been added. Others sometimes use a cold 3-percent hypochlorite solution. When washing solutions are used,



PMA 15710

FIGURE 7.—In this Texas packing house, tomatoes are washed by means of sprays from a series of nozzles before passing on a roller conveyor before the graders, who are shown at work in the right background.

the tomatoes are generally rinsed with a clear water spray as they emerge from the tank on a conveyor. Washing the tomatoes before they are sorted enables the sorters to detect and remove many defective specimens which otherwise might be missed.

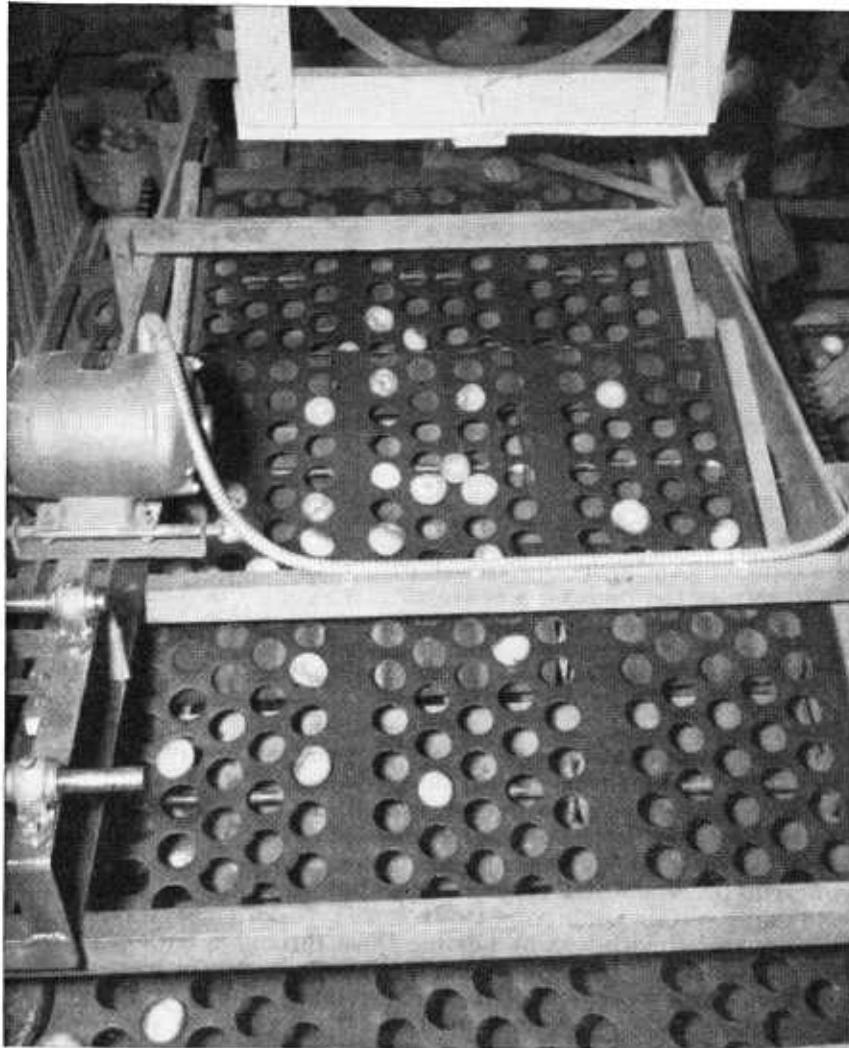
When tomatoes are washed, it is absolutely essential that they be dried before they are packed; otherwise the moisture would discolor the wrappers. Therefore most shippers who use washing machines, have also installed driers in which the tomatoes are dried from air circulated by electrically driven fans. In houses where the tomatoes are waxed, the tomatoes are conveyed from the washer directly to the waxing machine. As the tomatoes pass through the machine a very thin coating of wax is applied to the tomatoes by one of several different processes and types of machines now on the market and sold under certain trade names. In some types of machines the tomatoes are coated with wax by passing them through a bath containing a wax emulsion. In other types, a hot-wax, a solvent-wax, or even a dry-wax process is used. Most of such machines are equipped with drying fans to remove moisture from the surface of the tomatoes before they pass on to the packing belts or bins.

SIZING MACHINES

Most of the shippers in States that ship mature-green tomatoes now use mechanical sizing machines to size the tomatoes. During the past

10 years there has been a phenomenal increase in the installation of such machines in packing houses. Machine sizing of tomatoes picked in the pink and ripe stages is usually not practicable because of the danger of causing mechanical injury. Thus, in the northern producing States there is very little machine sizing because most of the tomatoes are marketed in the pink or ripe stages.

The type of machine now in general use for sizing tomatoes is shown in figure 8. The complete equipment of the machine consists of two units, a sorting unit and a sizing unit. In houses where tomatoes



PMA 15704

FIGURE 8.—View looking down on a sizing unit consisting of a series of continuous belts; each series is perforated with different-sized round holes. This type of sizing machine is now widely used by shippers in important producing States.

are washed and waxed these units are usually installed in the line immediately following the washing and waxing machines. If these units are not used, a hopper about waist high is placed at the head of the sorting unit to receive the tomatoes from the field containers. The tomatoes roll from the hopper onto the sorting unit, which consists of a series of rollers set on an incline of about 30°. From three to five sorters are stationed on each side and as the tomatoes move up this incline the rollers turn the tomatoes, thus enabling the sorters to see and remove defective tomatoes more readily. A conveyor belt running lengthwise through the center of the unit carries off the cull fruit.

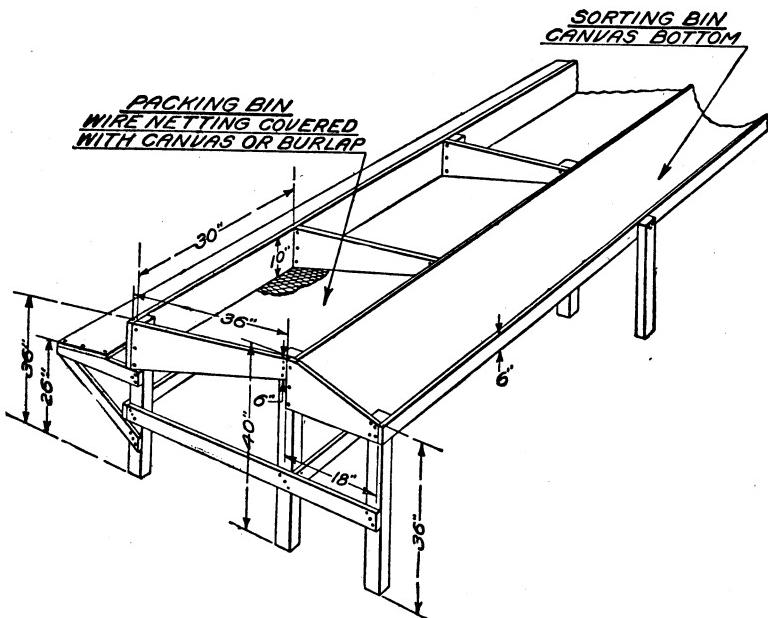
As the tomatoes reach the end of the sorting unit they roll onto the sizing unit. The sizing unit consists of a series of three wide rubber-covered continuous belts which are perforated with round holes at regular intervals. There is a difference of about one-fourth of an inch in the diameter of the holes in the three belts. The first removes the smallest tomatoes, the second the next larger size, and the third a still larger size. The largest tomatoes, which do not pass through any of the holes, drop off the end of the third belt. The newest machines of this type are equipped with cross transfer belts which convey the sized tomatoes either to conveyor belts leading to packing bins or to continuous belts from which packers select tomatoes for packing in containers. The packing of containers by selecting tomatoes directly from continuous belts represents the latest development in packing technique. This is the system now used in most California tomato-packing houses.

SORTING AND PACKING BINS

Even though mechanical sizing machines are now widely used in most of the important shipping States, many shippers still have not installed the continuous-belt system, and the packing bins are important units of equipment in the packing line. Also, where hand sorting and sizing are still practiced, as is the case in some of the less important producing States, the sorting and packing bins are the most important pieces of equipment.

Packing bins should be so designed that all the tomatoes in the bin are within convenient reach of the packers. It should not be necessary for the packer to rake or pull the fruit toward him. A very satisfactory design for packing and sorting bins is shown in figure 9. The packing bins should be about 6 inches deep at the back, 30 to 36 inches wide, and 36 to 48 inches from back to front, depending on the pitch of the bin floor towards the packer. The bottom of the bin is usually made of wire netting of about 1-inch mesh, stretched tightly and covered with burlap or canvas. The number of bins needed will depend on the volume of tomatoes handled. In some instances specially constructed bins have been installed which have movable bottoms hinged at the upper or the sorter's side and supported by coil springs at the packer's side. As the fruit is removed, the bottom of the bin is raised so that a supply is always within easy reach of the packer.

If a sorting bin, such as the one illustrated in figure 9, is used it should be about 18 inches wide and 6 inches deep. The bottom of the sorting bin should be made of canvas or burlap, similar to the bottom of the packing bins. If the tomatoes are to be sorted directly from the field containers, a bench can be attached to the sorter's side of the packing bins.



PMA 7794

FIGURE 9.—Type of sorting and packing bin in general use when grading is done after the field crates are emptied into a sorting bin.

OPERATION OF A PACKING HOUSE

Competent and careful supervision is necessary in the successful operation of a tomato packing house. The foreman in charge should be thoroughly familiar with the standards under which the tomatoes are packed and the various methods used for packing different sized tomatoes in the containers. He should be able to train employees in the art of sorting and packing as well as detect quickly any employee who is not doing his work properly. The failure of one or two employees to do their work in accordance with the standards set by the establishment may mean a considerable loss to a concern when final returns are calculated.

In most of the larger producing sections professional packers are employed. This is particularly true in southern and western areas where professional fruit packers move from place to place as shipping seasons progress. In many smaller producing areas local packers have proved to be more satisfactory than the professional who moves from place to place. Local help is usually more responsible and much easier to handle.

MOVEMENT OF THE TOMATOES THROUGH THE HOUSE

Packing-house equipment should be located within the house so that the minimum amount of labor is required in handling the tomatoes. Usually the movement will be across the width of the house, as the driveway and receiving platform will be along one side and the railroad tracks or driveway for receiving packed fruit will be on the opposite side. If the house is located on a railroad siding and an adequate

supply of cars is always available, storage space for packed containers need not be so great. In this case it would probably be best to locate the packing equipment lengthwise toward the track side of the house. This will leave ample space for receiving or stacking the unpacked fruit as it is delivered by the growers on the opposite side of the house, and the packed fruit will only have to be transported a short distance to the cars.

If the packing house is not on a railroad siding, or if for any reason a considerable amount of storage space for packed containers is needed, it would probably be best to locate the equipment lengthwise through the center of the house if adequate light can be provided.

Packing houses that were built a number of years ago are often not long enough to have all the latest equipment arranged in a continuous line. Fortunately, manufacturers of tomato-packing machinery have recognized this fact and most of it can be adapted to arrangement in any type of house. In some houses it may be advantageous to arrange certain units, such as the washer and sizing machine, across the width of the house at one end and then extend the sorting conveyor and packing line lengthwise.

RECEIVING THE FRUIT

An experienced employee should have charge of receiving the loose fruit from the growers. When tomatoes are bought at a flat price per field crate, he should make whatever deductions are necessary for poorly filled crates or improperly picked stock. In some sections purchases are usually made on a packed-lug basis. If the packing house is run on a cooperative basis, each lot should be tagged to show the grower's name and number of packages. As the various lots are sorted and packed, a statement of the number of lugs of each grade and size is added and the tag is sent to the office for the permanent record. Perhaps the most important duty of the receiver is to encourage growers to insist on proper care in picking and handling. When this phase of the work is overlooked, the cost of sorting is increased and frequently immature and badly blemished fruit is included, which results in a heavy loss.

The use of clamp or platform trucks or ordinary grain hand trucks to move the tomatoes from the unloading platform to the point where they are to be washed or sorted is an important labor-saving device employed in most packing houses. The type of truck used will depend largely on the kind of container in which the tomatoes are delivered to the packing houses. The truck may also be used to transfer the packed lugs to the loading platform or to the cars. However, most up-to-date houses are now equipped with roller conveyors which transfer the lugs from a point near the lidding benches directly to the cars or to the side of the house for stacking.

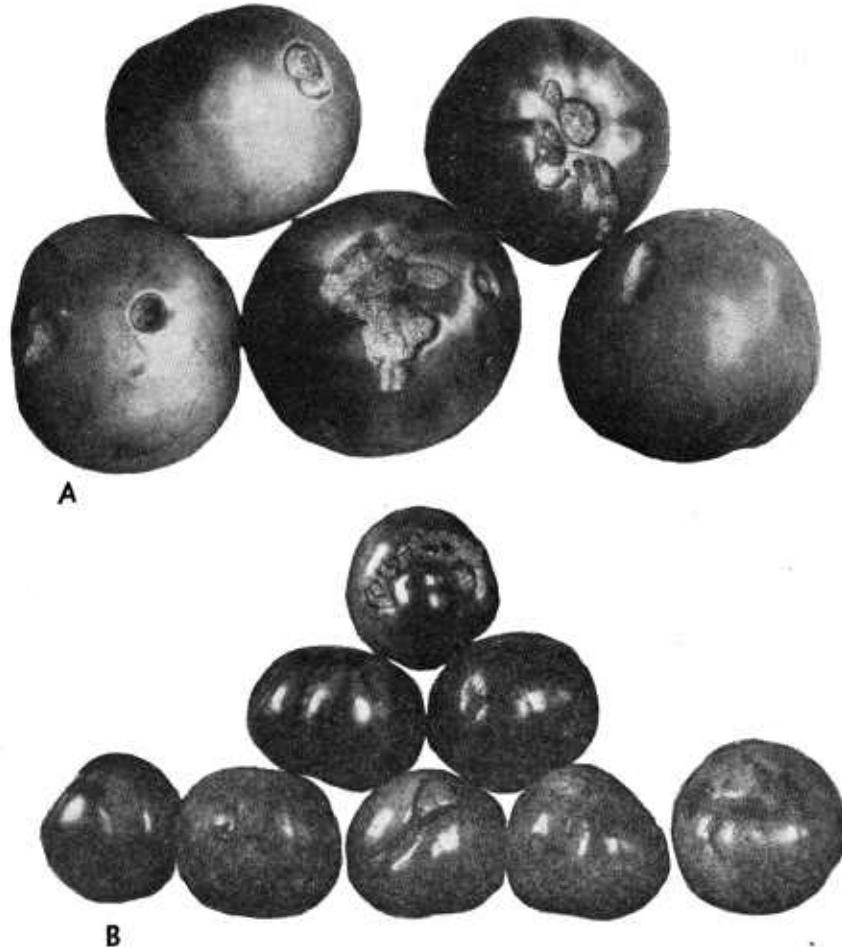
SORTING AND SIZING

Tomatoes are sorted by hand labor for market quality and defects. They are also sized entirely by hand in houses where sizing machines have not been installed.

In the more modern packing houses, where equipment is mechanized, the sorters are stationed on either side of the sorting unit which is usually installed just ahead of the sizing machine. The sorting unit

may be of the roller-conveyor type or simply a wide belt. The former is advantageous in that the tomatoes are turned as they move along the unit and this enables the sorters to see all parts of the tomatoes. Tomatoes which move on conveyor belts are not turned unless the sorters roll them over by hand, and the sorters may miss some of the defectives ones. However, there is probably less rubbing and skin abrasion when the tomatoes are conveyed on belts rather than on roller conveyors.

Packing-house operators claim that sorting from conveyor belts or roller conveyors enables a smaller number of sorters to do the same amount of work, gives greater uniformity in the quality of stock in the packed lugs, and provides a better distribution of fruit to the packers. Sorters should be arranged along the sorting unit according to their proficiency, the most experienced members of the crew giving

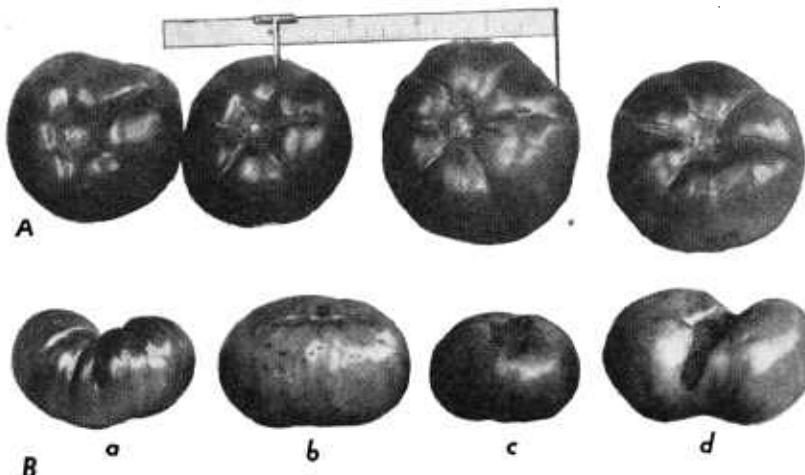


PMA 7695, 7702

FIGURE 10.—Worm-eaten tomatoes (*A*) and those injured by large stake or wind scars (*B*) should not be packed with the first-grade stock.

the final inspection. Sorters should be given thorough instruction by the foreman or someone well acquainted with the requirements of the grades being packed. They should be shown the various types of defective and diseased tomatoes which should be sorted out and a close check should frequently be made of their work to see that instructions are being followed.³ Various types of defective tomatoes are illustrated in figures 10, 11, and 12.

In packing houses that have not been mechanized, the sorters are usually stationed along one side of a series of bins and the packers work on the opposite side. Many packing-house operators, however, prefer to have the employees sort the tomatoes directly from the field containers instead of first dumping the tomatoes into sorting bins. They claim that the tomatoes are subject to less handling and so are less likely to become bruised. Sorting from the field containers also means less space in the packing house for the sorting operations.



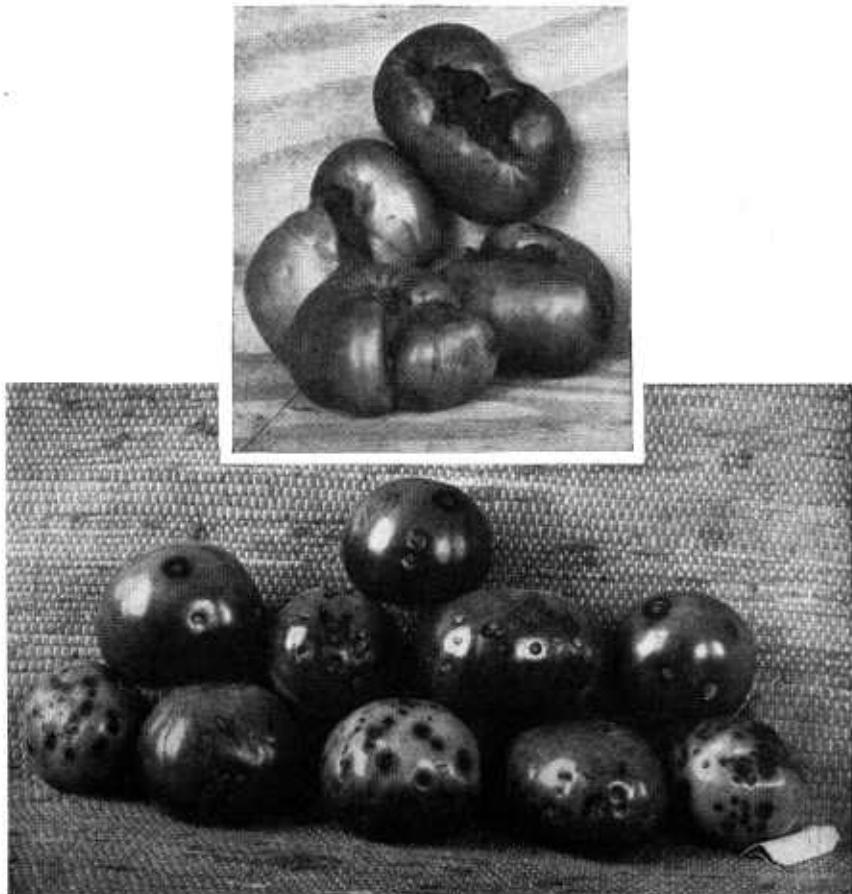
PMA 7700B, 7695B

FIGURE 11.—Tomatoes (A) showing deep stem-end or growth cracks and those (B) that are curly or rough (*a*), have smooth crooks (*b*), or show large scars and catfaces (*c* and *d*) should be sorted from the first-grade stock.

Those packing-house operators who dump the tomatoes into sorting bins before they are sorted contend that the sorters have more freedom of action and a better opportunity to see the blemished fruit than when they are sorted from the field containers. If mature-green stock is being packed, the pink or ripe tomatoes are placed in field crates and carried to special packers or placed in separate compartments of the bin. The fruit that is satisfactory for packing is placed in the packing bins directly in front of the sorters.

In some packing houses the sorter also does the sizing. As he handles each tomato he gages the size by eye and places it in the bin intended for that size. In other packing houses the sorters merely separate the fruit into the various grades, and it is left to the packers to select the tomatoes of the proper size for the particular pack they are making.

³ Farmers' Bulletin 1934, Tomato Diseases.



PMA 7691A, 7701A

FIGURE 12.—Bad "catfaces" and tomatoes affected with nailhead spot (*Alternaria tomato*) should be excluded even from the second grade.

Machine sizing of tomatoes undoubtedly insures more uniform sizing of tomato packs than sizing by hand. However, since there are usually only four different sizes separated by the machines, the packers must pack more than one size of tomatoes from some of these separations. Unless he selects the proper size for the pack he is making, the pack still might not be considered fairly uniformly sized. Irregular sizing from many sections is a constant complaint of receivers in the markets. In most instances they are willing to pay a premium for uniformly sized fruit.

PACKING

PACKING THE LUG

The lug-box pack now employed generally throughout those areas that ship green-wrap tomatoes is prepared in central packing houses under the supervision of the shipper. Experienced packers are usually

employed for this work, as they must turn out considerable volume in order to make the use of this kind of package profitable.

The packer works at a slightly inclined bench directly adjacent to the bins in which the sorted tomatoes are placed (fig. 13) or next to the conveyor belts in houses where bins are no longer used. He faces in the direction of the bench upon which the empty lug is resting at a convenient height. The paper holder is either attached or placed within convenient reach at the side of the lug/box. A rubber finger cot is often worn by the packer on the thumb or forefinger to facilitate removal of the paper. The packer picks up a wrap from the holder and at the same time selects a tomato from the bin. The tomato is tossed into the palm of the right hand, which is holding the wrapper.



PMA 15702

FIGURE 13.—Packers in this Texas packing house pack the lugs with tomatoes selected from adjacent bins, after which they place the lugs on the roller conveyor leading to the lidding press.

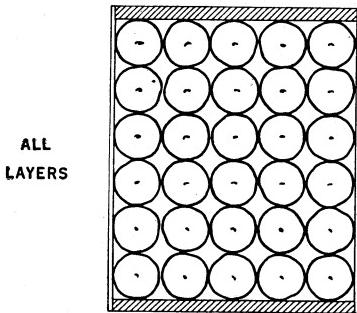
This jerks up the edges of the wrapper, and the left hand is quickly brought forward to fold the loose edges of the wrapper around the tomato or to hold it while the tomato is given a half twist. The wrapped tomato is then placed in its proper position in the lug, with folded or twisted portion underneath to act as a cushion, while the left hand reaches for another tomato. If the packer is left-handed he will face in the opposite direction and the movements of right and left hands will, of course, be reversed. The experienced packer will pack tomatoes about as fast as he can pick them out of the bin.

In packing a lug to secure the proper bulge, skilled packers usually select slightly larger tomatoes for the center of the lug than for the ends. Some tilting of the fruits is also practiced as necessary. As a result of these practices the tomatoes in the center of the lug are usually more tightly packed than those in the ends.

The general shape of the tomatoes and the size determine to a large extent the manner in which the packer will arrange the tomatoes in the lugs. Obviously, distinctly globe-shaped tomatoes must be arranged differently than those that are generally flat-shaped. In general, tomatoes of the larger sizes are packed flat in all three layers. It is usually necessary to pack medium- and the small-sized tomatoes on edge in one or more layers to secure the proper height of the pack. Often the two lower layers of tomatoes are packed on edge and the top layer flat with blossom end up. Certain other sizes will be packed with the tomatoes on edge in all layers. Each individual packer usually develops his own technique for arranging different sizes and shapes of tomatoes in the lugs. From all outward appearances the similar-sized packs of tomatoes put up by different packers may be the same but close examination may show that the position of individual tomatoes with respect to packing flat, tilting, or packing on edge varies considerably.

Whenever the packer finishes packing a lug he places a numbered pasteboard or ticket on the lug, which is then removed to the lidding bench or to the conveyor leading to that point. These tickets are collected by the lidder and sent to the office for recording the packer's daily output.

SQUARE ARRANGEMENT



PMA 15823

FIGURE 14.—Diagram illustrating the square arrangement for packing tomatoes in lugs, which is the method commonly used in all producing sections. In this arrangement one tomato is placed directly above another in the various layers, thus making the relative position of the tomatoes the same in all layers. The size of tomatoes as shown in this diagram is designated as 5×6 .

Aside from these general practices employed in packing lugs, tomato packers in the various sections have developed three distinct methods of arranging the tomatoes in the different layers. The common practice in all sections where the lug is used is to place the tomatoes so that one tomato will be directly above another in the various layers. This is known as the square arrangement and is illustrated in figure 14.

Some shippers, particularly in California, use a method known as the offset arrangement for some sizes of fruit. In this method (fig. 15) alternating space is left at the end of each row in each layer, and theoretically the weight of each tomato in one layer is supported by two tomatoes in the next lower layer.

In the third method of arrangement, termed "diagonal," a certain amount of space is left between each tomato in each layer. This

method is illustrated in figure 16 and is used by some California shippers for packing small-sized tomatoes. Four layers of fruit are packed in the lug where this method is employed. Two layers will have one

OFFSET ARRANGEMENT

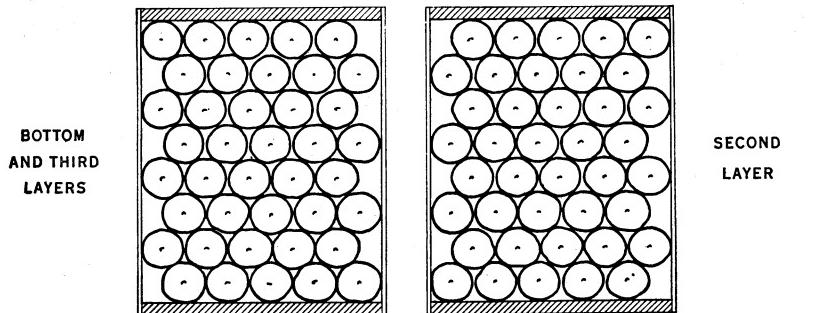


FIGURE 15.—Diagram illustrating the offset arrangement for packing tomatoes in lugs used by some shippers. Alternating space is left at the end of each row in each layer so that the weight of each tomato in one layer is supported by two tomatoes in the next lower layer. If this arrangement is used for small tomatoes a fourth layer is included, and the position of the tomatoes will be the same as in the second layer shown in the diagram. The size of tomatoes arranged in the top layer as shown in the diagram is designated as 5 x 8.

more tomato than the other two layers, depending on the manner in which the packer starts the pack. As shown in figure 16, there are 5 rows of 5 and 4 rows of 4 tomatoes extending crosswise of the lug, making a total of 41 tomatoes in the bottom and third layers. In the

DIAGONAL ARRANGEMENT

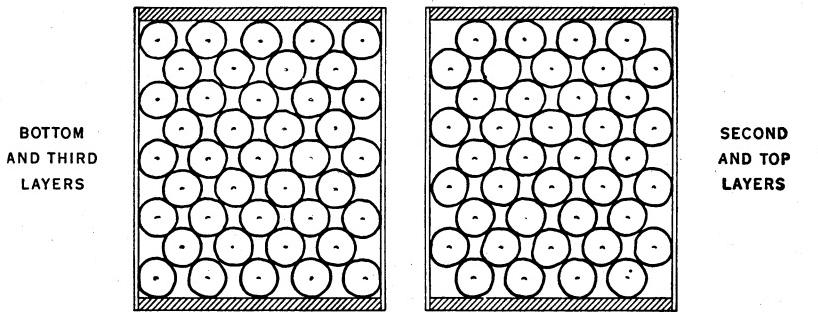


FIGURE 16.—Diagram illustrating the diagonal arrangement in layers for packing tomatoes in lugs used to some extent for small tomatoes by some shippers. A certain amount of space is left between each tomato in each layer and four layers are packed in the lug to build the pack to the proper height and secure the required net weight. Note that the bottom and third layers contain one more tomato than the second and top layers. The size of tomatoes arranged as shown in this diagram is designated as 4-5 x 9.

second and top layers there are 5 rows of 4 tomatoes and 4 rows of 5 tomatoes, or a total of 40 tomatoes in these layers. The diagonal pack is more difficult to pack properly than either the square or offset pack.

Five styles of lug packs are recognized in the United States standards for fresh tomatoes. They are straight pack, extra-row pack, bridge pack, double-wrap pack, and double-wrap bridge pack. In all of these styles of packs the tomatoes must be at least fairly uniformly sized, and the net weight in the lugs shall be not less than 30 pounds in order to be considered as United States standard packs.

A straight pack is packed with the same number of rows of tomatoes each way of the lug in each layer. Receivers in the markets generally favor the straight pack over all other styles of packs and it is becoming increasingly more popular each year. This style usually insures greater uniformity in size of the tomatoes throughout the lug. Some of the most common U. S. straight packs and the method of arranging the tomatoes in the lugs are shown in figure 17. In these diagrams wide cleats are used on the lugs. Many shippers use narrow cleats of the same width as the end pieces of the lug, thus insuring greater uniformity of size in all layers.

U. S. STRAIGHT PACKS

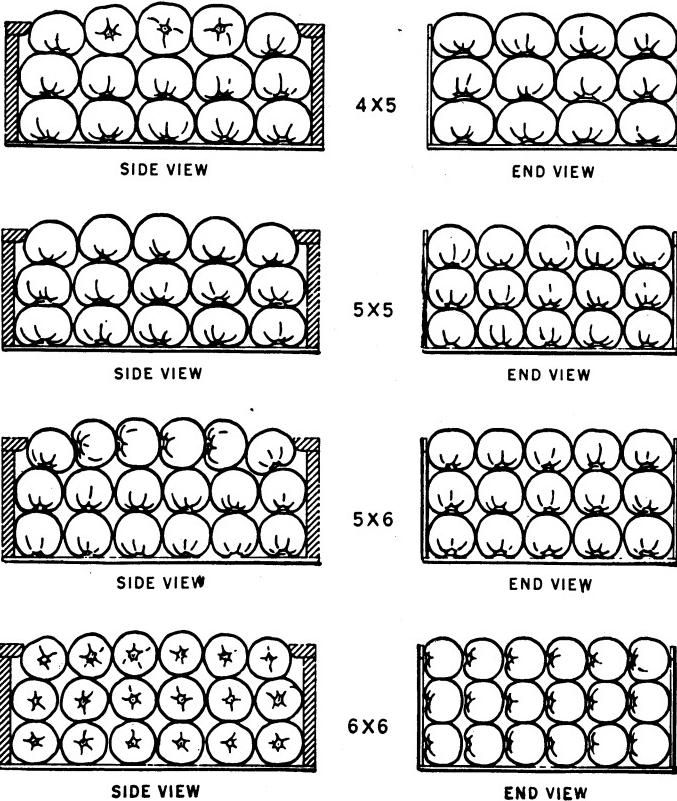
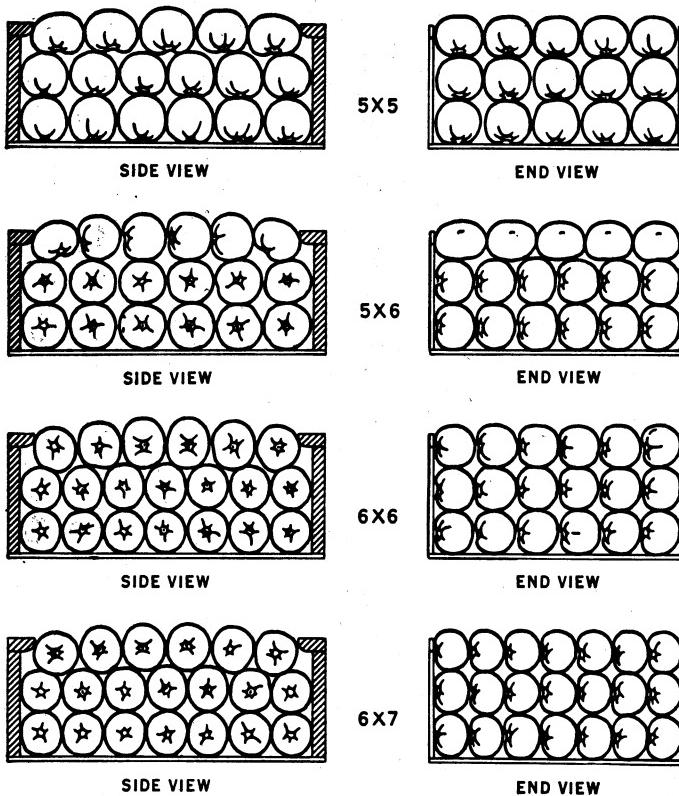


FIGURE 17.—Diagram showing the arrangement commonly used by packers for packing various sizes of U. S. straight-style packs. Note that all layers have the same number of tomatoes and that they are fairly uniform in size. Receivers generally favor this style of pack.

FMA 15824

U. S. EXTRA ROW PACKS



PMA 15825

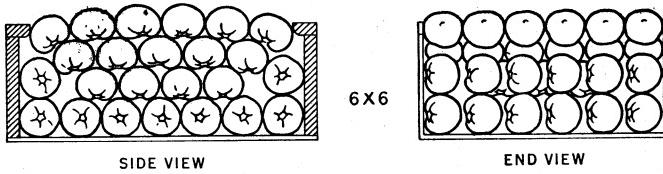
FIGURE 18.—Diagram showing arrangement commonly employed by packers for packing various sizes of U. S. extra-row style packs. Note that the top layer in each pack has one row less of tomatoes one way of the lug than the lower layers and that the tomatoes are generally somewhat larger.

In the extra-row style of pack the top layer contains one row less of tomatoes one way of the lug than the other layers. Therefore, the tomatoes in the top layer will be somewhat larger than those in the other layers. If the lugs are fitted with wide cleats the variation in size in the layers need not be so great, although the width of the cleats extending over the ends of the lug is not enough to compensate for the full width of a row of tomatoes. The extra-row style of pack is often severely criticized by receivers in the markets because the tomatoes in the top layer, or shown face, are larger than the tomatoes in the other layers. This style of pack is still used extensively but in many sections is gradually being supplanted by the straight method. Common methods of arrangement employed by packers in packing U. S. extra-row packs with various sizes of tomatoes are illustrated in figure 18.

The term "bridge pack" is used to describe the style of pack having three full layers and part of a fourth. It is employed mostly for tomatoes of the smaller sizes, where three layers will not fill the lug

to the proper height and insure the required net weight. The bridge is usually made by leaving one or two rows vacant both ways of the lug in the second layer. However, some Texas packers make the bridge by spacing the tomatoes apart. The upper two layers are then packed regularly and the bridge tends to give the proper height and weight to the pack with the bulge in the center. The position of the tomatoes in a typical U. S. bridge pack is illustrated in figure 19.

U. S. BRIDGE PACK



SIDE VIEW

6X6

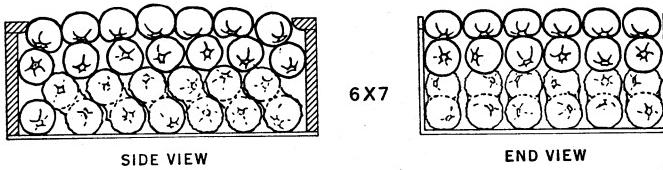
END VIEW

PMA 15820

FIGURE 19.—Diagram showing the position of the tomatoes in a typical U. S. bridge pack. The bridge is used to build the pack to the proper height and secure the required net weight.

Often small-sized tomatoes are packed with two tomatoes in a wrapper in the bottom layer and sometimes in the middle layer as well. This style of pack is called the double-wrap pack. In starting the pack one row of tomatoes wrapped double is placed flat in the end of the lug nearest the packer. The layer is then completed by wrapping two tomatoes in each wrapper and placing them in the lug at an angle so that one tomato when in position is about half the depth of a tomato higher than the other. This is to insure filling of the lug to the proper height. The tomatoes in the second layer are wrapped either singly or doubly. The tomatoes in the top layer are wrapped in a single wrapper. Figure 20 illustrates the arrangement of the tomatoes in a U. S. double-wrap pack, with the lower layer only having two tomatoes to the wrapper.

U. S. DOUBLE-WRAP PACK



SIDE VIEW

6X7

END VIEW

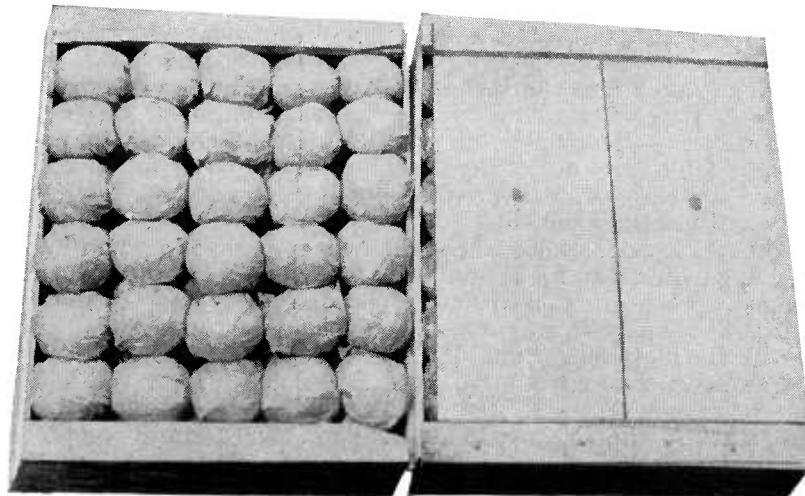
PMA 15819

FIGURE 20.—Diagram showing the position of the tomatoes in a U. S. double-wrap pack commonly used for small-sized tomatoes. The diagram shows only the tomatoes in the bottom layer wrapped double. Often the tomatoes in the middle layer are wrapped double.

The double-wrap bridge pack is a recent development in packing technique. It is simply a combination of the double-wrap and bridge packs just described. In order to be considered standard, this pack must contain tomatoes that are fairly uniform in size and fairly tightly packed. The tomatoes in the top layer must be packed in separate wrappers and in the lower layer or layers not more than two tomatoes

may be packed in a wrapper; furthermore, a part of an additional layer which may have either one or two tomatoes in a wrapper must be packed in the lug.

The size of tomatoes packed in lug boxes is designated commercially by the number of rows of tomatoes running both ways of the lug in the top layer, with the exception of lugs packed with the tomatoes arranged diagonally. For example, the top layer of a lug packed with five rows of tomatoes extending lengthwise and six rows extending crosswise would be designated as a 5 x 6 pack (fig. 21). The designation of size, by stating the number of rows of tomatoes both ways of the lug, applies to all styles of packs heretofore described and to all methods of arrangement except the diagonal. Shippers at present are designating size of diagonal packs by using two figures to show



PMA 7815

FIGURE 21.—The size in most lug packs is designated by the number of rows of tomatoes running both ways of the lug in the top layer. This represents a well-packed lug box showing medium-sized tomatoes packed 5 x 6.

the number of tomatoes in the rows crosswise of the lug and a third figure to indicate the total number of crosswise rows in the layer. For example, the size of the tomatoes in the diagonal pack illustrated in figure 16 is designated 4-5 x 9, which means that there are four and five tomatoes in the alternating rows crosswise of the lug with nine such rows in the layer. Other diagonal arrangements commonly packed are 4-4 x 10, 4-5 x 10, and 4-3 x 12.

The methods now employed for designating size are often misleading and are frequently the cause of disputes between shippers and receivers. A description of the top layer does not always give a true picture of the size of the tomatoes in the lower layers. The tomatoes in the lower layers of extra-row packs are generally smaller than those in the top layer. The same may be true of bridge and double-wrap packs. The method now employed for describing size of diagonal packs is difficult to understand and the distant buyer not thoroughly acquainted with the method may find it hard to visualize the size of tomatoes

quoted. A better method of describing the size of tomatoes packed in lugs would be to specify the number of tomatoes in the package, provided the tomatoes are fairly uniform in size.

PACKING CLIMAX, SPLINT, AND FIBERBOARD BASKETS

The packing of tomatoes in climax, splint, and fiberboard baskets is much less complicated than packing tomatoes in lugs. For this reason these types of packages are adapted for use in the East North Central and Middle Atlantic States, where the fruit is mostly packed at the farm in the pink and ripe stages by the producer or members of his family. In Ohio, however, considerable quantities of both greenhouse and field-grown tomatoes are packed in baskets at central packing houses.

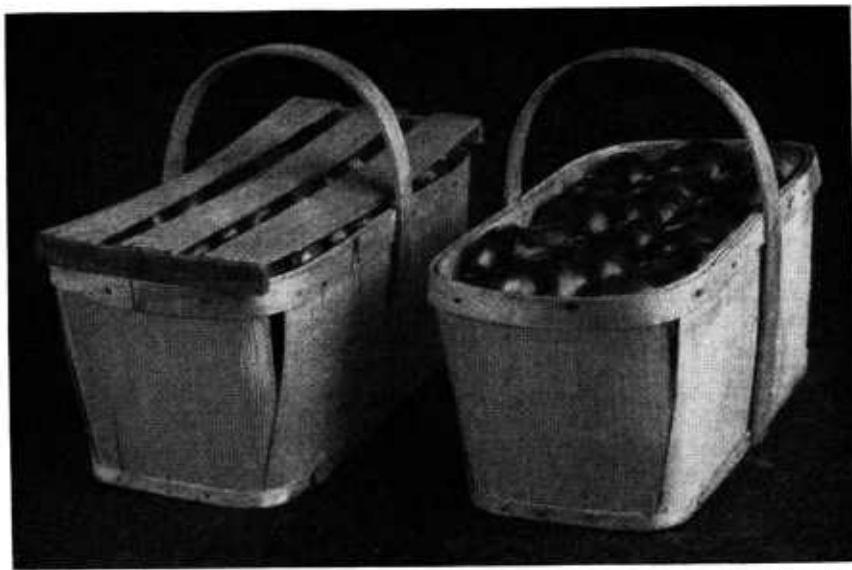
As a general rule producers of field-grown tomatoes using 12-quart climax baskets do not sort the fruit to uniform sizes and pack them in separate containers. Many producers pack separately the small-sized fruit under 2 or $2\frac{1}{4}$ inches in diameter, but the rest is packed together. This often gives a range in size from about 2 inches to over 4 inches in diameter in the same package. Some dealers prefer to handle fruit more uniformly sized but others would rather have a range of size to satisfy the varied wishes of consumers.

Medium and large tomatoes are generally packed three layers deep in 12-quart climax baskets. If small fruit is packed separately four layers are required to fill the basket. As a rule the tomatoes are not wrapped. They are packed flat or on edge, depending on the size. Often the lower layers are packed on edge and the top layer is packed flat with the blossom end up. In New York, New Jersey, and Pennsylvania most growers aim to pack 20 pounds net to the basket. Some producers simply fill the package and pay no attention to the net weight. Michigan growers usually pack from 15 to 18 pounds net per basket. Packed climax baskets of 12-quart capacity are illustrated in figure 22.

The 8-quart splint and fiberboard baskets are packed with two layers of fruit. Growers of greenhouse tomatoes generally wrap the better grades of fruit, especially if it is to be transported any great distance. Small-sized tomatoes and fruit of the lower grades are usually not wrapped. Since greenhouse tomatoes are ordinarily picked with stems and calyxes attached the wrappers offer considerable protection to the fruit from stem punctures.

It is customary for the greenhouse growers to pack separately three different sizes of fruit which they class as small, medium, and large. Tomatoes under 3 ounces in weight are considered small. Those ranging from 3 to about 8 ounces are classed as medium and those over 8 ounces are considered large. The lack of uniformity in size of fruit classed as medium and large is not desirable from the standpoint of some dealers. However, many dealers prefer to have different sizes of tomatoes in a small package to meet the different needs of consumers.

In Ohio, where the 8-quart baskets are now used almost exclusively, producers of field-grown tomatoes pack 10 pounds to the basket whereas greenhouse growers pack only 8 pounds to the basket. Most of the greenhouse growers and many producers of field-grown fruit place pasteboard dividers between the layers of fruit. It is common



PMA 7836

FIGURE 22.—The 12-quart climax basket is usually packed with three layers of tomatoes.

practice to lid the packages with closely fitting fiberboard covers, but some growers do not lid packages that are trucked to nearby local markets.

The 16-quart fiberboard baskets, which are becoming increasingly popular for packing field-grown tomatoes in the East North Central States, are ordinarily packed with 20 pounds of tomatoes. They are placed in three layers with pasteboard dividers between each layer.

PACKING HAMPERS AND ROUND STAVE BASKETS

Packing the $\frac{5}{8}$ -bushel hamper and the $\frac{1}{2}$ - and 1-bushel baskets with pink and ripe tomatoes for trucking to nearby markets in the Eastern States is a comparatively simple operation. As a rule all sizes of tomatoes are jumbled in these containers. Some growers, however, often ring-face the top layer with fairly uniform-sized tomatoes, with blossom end up, in order to give the package a more attractive appearance. Ring-facing packages is not to be recommended unless the tomatoes in the shown face are reasonably representative in size and quality of the remainder of the tomatoes in the package.

Care should always be exercised in placing the tomatoes in hampers or baskets to prevent unnecessary bruising of the fruit. Overripe tomatoes should not be allowed in the package as they are likely to be crushed.

PACKING THE 25- AND 50-POUND BOXES

Rackers in Atlanta, Ga., arrange the tomatoes in 25- and 50-pound boxes in regular rows and layers. The tomatoes so packed are usually fairly uniformly sized and a pasteboard divider is placed between each layer of fruit. The repackers mark the size on the box to correspond with the size of tomatoes in lug boxes. Thus, the tomatoes of a

size that will pack 6 rows wide and 7 rows long in lugs are marked "6 x 7" on the boxes. Such marking of these containers therefore has no relationship to the number of tomatoes in the box and would be confusing to anyone not familiar with the practice.

PACKING THE WESTERN PEACH BOX AND THE FOUR-BASKET STRAIGHT-SIDED CRATE

The western peach box used in some parts of the West for local shipments is ordinarily packed by the growers. Usually two layers of fruit are packed in more or less definite rows in this container.

The four-basket straight-sided crate used for local shipments of ripe fruit in California is also packed by the growers. Each till basket is filled with two layers of tomatoes, but little attention is given to uniform sizing of the fruit.

MARKING PACKAGES

It is general trade practice to stamp the style of pack in the upper corner of one end of the container when tomatoes are packed in lugs. The size of tomatoes packed in lugs is designated by the arrangement of the tomatoes in the top layer. For example, a lug packed 5 rows wide and 6 rows long in the top layer is stamped 5 x 6. In some packing houses the grower's initials or his lot number are also marked on the package.

During recent years many States have enacted laws requiring certain other markings to be shown on packages. In general, these laws require such markings as the name of the variety, the place where grown, the name of the grower or his lot number, the grade, and the net weight or numerical count. Shippers should consult the laws of their State to make sure of the markings required to be shown on tomato packages.

Under the provisions of the Federal Food, Drug, and Cosmetic Act a food shall be deemed to be misbranded if in package form unless it bears a label containing (1) the name and place of business of the packer or distributor and (2) an accurate statement of the quantity of the contents in terms of weight, measure, or numerical count. Therefore it is general practice to show the name and address of the shipper or packer on all packages of tomatoes which enter into interstate commerce. Lugs and crates are also marked to show the contents in terms of net weight; and baskets, in terms of dry measure.

Most tomato shippers who pack lug boxes use lithographed or printed labels to identify their particular brands. These should be attached neatly to the containers, as careless labeling always gives the impression that the pack is also poor. Generally labels are pasted on before the empty containers are furnished to the packers but some shippers do the labeling in the car as each stack is stowed.

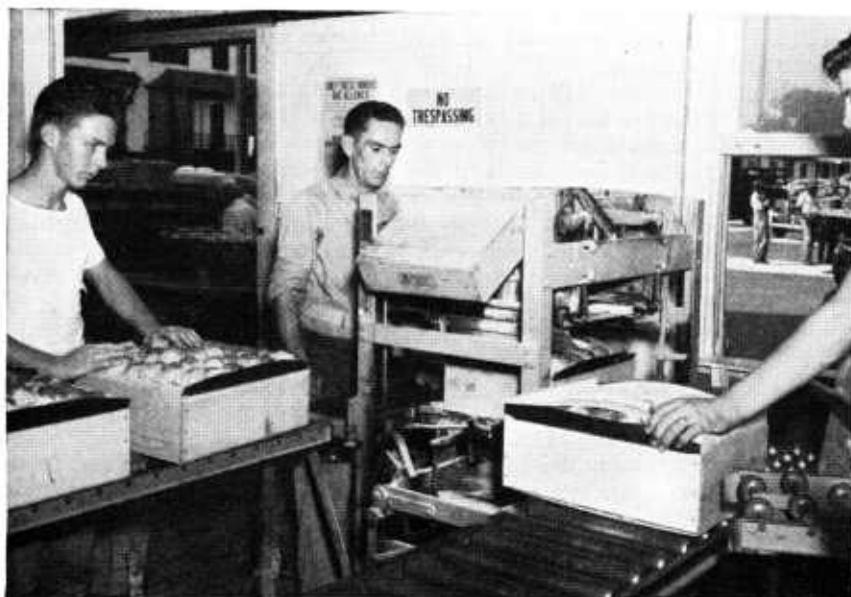
LIDDING

In most of the central packing houses where lugs or other packages requiring nailing are packed, the lidding is done by hand with the aid of a lidding press. The lidding press also serves as a lidding bench. It consists of a framework equipped with press arms which

are operated by means of a foot lever. The operator places a packed lug in the press, places the lid in position over the fruit, and applies enough pressure on the foot lever for the press arms to force down the ends of the lid flush with the end pieces on the lug. He then drives the nails and releases the foot lever to allow the press arms to spring back to their normal position.

If a lidding press is not provided, a substantially constructed lidding bench of convenient height should be furnished the nailer.

Lidding presses or lidding benches are usually placed in the rear of the packers' aisle parallel to the packing bins. If the packers place the packed lugs on a roller conveyor leading to the lidding press or lidding bench, it is most convenient to have the top of the rollers



PMA 15707

FIGURE 23.—Electrically operated lidding machines are often used in packing houses where a large volume of tomatoes is packed.

even or slightly above the top of the bench so that lugs will slide easily into position for nailing. The lids should be within easy reach of the nailer from a rack overhead or in a stack to one side. If a lidding press is not provided, the lidder nails first one end and then the other, the pressing being done by hand. It is sometimes necessary to settle the fruit packed in a lug with a high bulge by a jar or by a shaking movement before completing the nailing.

Some of the larger packing houses that handle a large volume of fruit are now equipped with electrically operated lidding machines, such as is illustrated in figure 23. The operator in charge simply fits the lid in place over the fruit and presses a button with his foot and the machine does the nailing. Such labor-saving devices installed in packing houses where considerable volume is handled no doubt tend to cut down overhead costs.

LOADING THE CAR

Fresh tomatoes transported to market by rail are usually loaded in refrigerator cars. When loading a car the packages should be so arranged and the load so braced that it will not shift in transit, and the packages should be placed so as to permit free circulation of air.

Lug boxes, which comprise the bulk of the shipments by rail, are mostly loaded in accordance with the provisions of the freight loading and container tariffs. These tariffs specify that the loading be cross-wise, that double crosswise horizontal car strips be placed on all layers, that the strips on each layer alternately abut the side walls of the car, and that all strips be nailed to each lug in the layer. Thus, the usual loading is 5 rows wide and 5 or 6 layers high with 24 to 26 stacks, depending on the length of the car. Five-layer loads usually have from 600 to 660 packages to the car, whereas 6-layer loads may have 720 to 780 packages.

It is usually necessary to brace the load in the center between the doorways of the car for, as a rule, the stacks will not just fill the lengthwise space. Sometimes excess space is taken up by the use of end bulkheads in one or both ends of the car. Stripping of each layer in each stack is also necessary to insure holding the load intact.

The load is started in the car by placing five lug boxes tightly against the bunker wall in one end, leaving equal spaces between the lugs and also between the lugs and the outside walls. When the layer is in place it is ready for stripping. The car strips should be made of good-quality lumber, preferably 1 inch but not less than $\frac{1}{2}$ inch thick, 1 inch wide, and about 8 feet long. Two strips are placed across the layer about 1 inch from the edge of the lugs, with the end of one strip butting against one wall and the end of the other strip butting against the opposite wall (fig. 24).

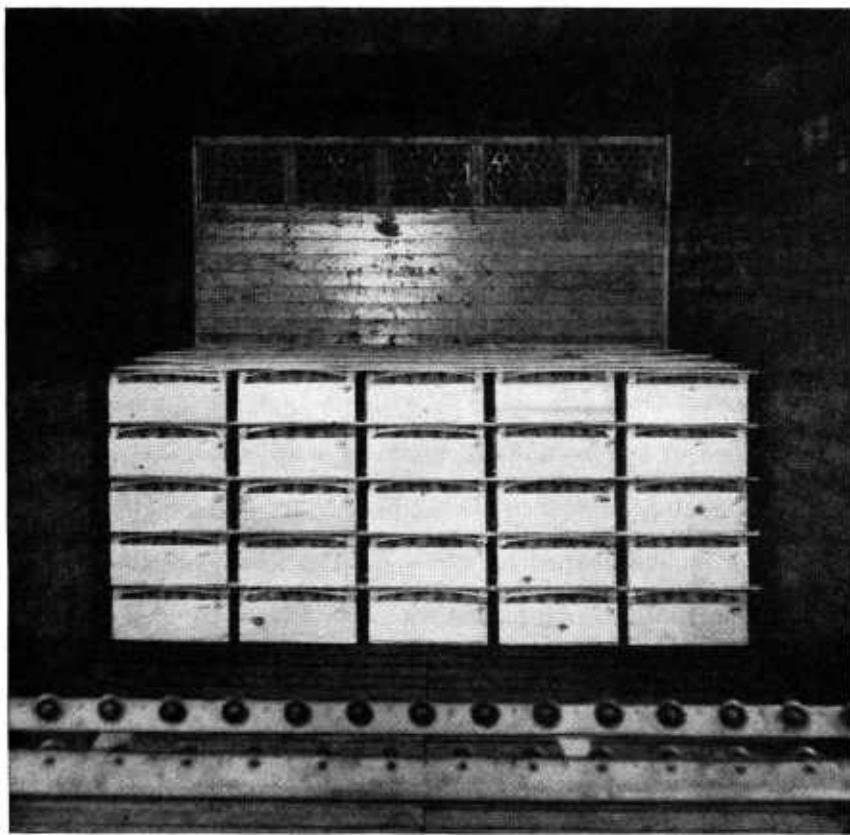
The principal purpose of this arrangement is to brace the load from both sides and keep the rows evenly alined. The strips should be nailed with one nail in each package.

The stack is completed by placing additional lugs directly above those already in place and stripping each layer in the same manner as the first. The other stacks are then stowed by placing each lug box directly in front of those in the first stack.

As each stack is stowed, it is advisable to place a board in front of each tier of lugs and tap it lightly in various places with a small sledge hammer. This will assist materially in maintaining a tight load. The opposite end of the car is loaded in a similar manner. If the lugs do not entirely fill the lengthwise space in the car the load must be center braced.

Many shippers use a standard type of center bracing consisting of two gates which fit against each face of the load. Each gate consists of five uprights held together by two crossbars. The uprights are made of 2- by 4-inch lumber, two of which reach to the ceiling of the car. As many cross pieces of 1- by 4-inch material as there are layers of packages are nailed across the uprights so as to be against the middle of the lugs in each layer. Three spreaders 2 inches by 4 inches, cut slightly longer than the space between the uprights, are wedged and nailed between the uprights on each gate to lock the bracing.

It should be emphasized that the proper nailing, stripping, and bracing of loads is very important if broken packages and those in bad



PMA 7763

FIGURE 24.—Lug boxes are generally loaded in refrigerator cars five rows wide and five or six layers high. Each layer of lugs is double-striped, with the end of one strip butting against one wall and the end of the other butting against the opposite wall.

order are to be held to a minimum. Recent studies have shown that cars properly nailed and stripped arrived in the markets with much less damage to packages than those with improper nailing and stripping.⁴

Another type of loading lug boxes which is used by some shippers, particularly in California, is the Hoak method. This method of loading is patented, and any shipper using it must pay a fee for the privilege. As in the conventional method of loading, lugs are loaded crosswise of the car but instead of horizontal stripping being used, vertical spacing strips or units are placed upright between the stacks and rows of containers to hold them in place. Each spacing unit consists of three wooden strips. One strip $\frac{1}{8}$ of an inch thick and from $3\frac{1}{2}$ to 4 inches wide is placed flush between two other strips of the same length that are about $1\frac{1}{4}$ inches thick and $1\frac{1}{2}$ inches wide. These strips

⁴ See Reduction of Loss and Damage in Rail Transportation of Fresh Fruits and Vegetables by Improved Loading Methods. BAE, USDA. August 1946. [Processed.]

are nailed together in such a way that when the units are placed vertically at the point where the corners of the containers in all layers of two adjacent stacks and two adjacent rows approach each other, the containers in each stack and each row are held firmly in place. By this method each container is held tightly in row and stack alignment, and crosswise and lengthwise slack and load shifting during transit are kept to a minimum.

Another more recent type of loading is the Ellis inverted "V" method, also patented and used for a limited number of California shipments. In this type of loading the lugs are loaded crosswise of the car and no horizontal stripping is used. The load is held in place by wooden frames fashioned into inverted V's and placed in an upright position between the outside rows of containers and the side walls of the car and usually on each side of the center row of containers. The spacing frames are made from 2- by 3-inch or 2- by 4-inch lumber and are held together at the apex by a nail or metal fastener.

Movement of tomatoes to market by rail in containers other than lugs is relatively small, the bulk of the movement being by motor-truck. Tomatoes packed in climax baskets are occasionally shipped by rail, in which case the load may vary from 700 to 1,000 baskets, depending on the method of stowing. The load generally extends through the full length of the car and is 11 rows wide and 4 or 5 layers high. Sometimes a car is loaded with only 1 layer between the doorways, the load sloping to 5 layers at the end.

Eight-quart baskets of tomatoes when shipped by rail are usually loaded full length of the car crosswise and lengthwise, 6 and 12 rows wide, respectively, and with a varying number of layers. Depending on the number of layers, loads may vary from 1,200 to 2,600 packages per car.

GRADES AND INSPECTION

Wholesale trading in fresh tomatoes is largely conducted on the basis of the United States standards. Standards for field-grown tomatoes were first issued in 1922, and in 1933 standards for greenhouse tomatoes were established. The standards define in detail the requirements of the various grades and packs and prescribe the markings that should be shown on the packages. Copies of these standards are available for distribution by the Production and Marketing Administration, United States Department of Agriculture.

The Federal-State inspection service at shipping point is available in practically all of the important commercial tomato-producing areas. Licensed Federal-State inspectors will inspect a shipment for a small fee and issue a certificate showing the quality, condition, grade, and size of the fruit, together with other facts, such as the type of pack, kind of containers used, and method of loading (fig. 25). Federal inspection is also available in the larger markets and the territory adjacent to them.

A total of 30,863 carloads of tomatoes was inspected at shipping points during the calendar year 1947, which included about 6,800 cars of Mexican tomatoes inspected at the border in Arizona. This number was approximately 92 percent of the total carlot movement, including the importations from Mexico.



PMA 15708

FIGURE 25.—Licensed inspector examining the tomatoes in a packed lug. A large percentage of the carlot shipments of tomatoes are inspected at shipping points by licensed Federal-State inspectors, who issue certificates showing the grade, quality, and condition of the tomatoes in the cars.

The general use of standards by growers and shippers has many advantages. As a basis for trading, their use tends to establish confidence among buyers and sellers, which helps to widen the market. The standards serve as a common language between the shipper and the distant buyer and provide a basis of quoting sales which is generally understood throughout the industry. Inspection at shipping point under established standards tends to prevent unjustified rejections at destination in the case of sales made f. o. b., usual terms. Better production methods among growers are encouraged by the use of standards, as produce of the higher grades usually sells for a premium in price over that of the lower grades or field-run fruit. The presence of large quantities of poor-quality and ungraded tomatoes on the markets adversely affects the sale of good-quality stock.

HANDLING AND PACKAGING IN THE MARKETS

The discussion of preparation of tomatoes for market would not be complete without describing the handlings which tomatoes must pass through after they reach the market centers. There is still much work to be done before a shipment of mature-green tomatoes arriving in a market center is ready for retailing to consumers. Inspection of the

individually wrapped tomatoes so nicely arranged in rows and layers in the lug boxes would probably reveal that some are overripe and soft, others firm ripe and just ready for eating, some turning, and many of them still green. In addition, some tomatoes are usually decayed. The retailer is not interested in such a mixture because the consumer will not, as a rule, buy green tomatoes nor does he want them overripe or decayed. Thus, the painstaking work of the shipper in packing the tomatoes for shipment must be undone, and the responsibility for resorting and repacking the tomatoes to suit the needs of the consumer finally falls upon the receiver in the markets.

First the car is unloaded and, if the receiver is not located on a railroad siding, the tomatoes are trucked to his store. Chain store headquarters are usually located on railroad sidings. Most of the larger tomato dealers and many chain stores have special facilities for handling the tomatoes. These consist of a packing room containing more or less mechanized equipment. Several small ripening and storage rooms, where temperatures and humidity can be controlled, are usually located adjacent to the main packing room. Very often the rooms of regular tomato repackers for ripening, storage, resorting, and repacking are located above the sales room which is ordinarily on the street floor.

As soon as a lot is unloaded, the receiver proceeds immediately to have the tomatoes sorted. Removal of the paper wraps is the first operation. This is a laborious task by hand, so most repackers have provided wrap exhausters, where air blasts from a suction fan remove the wraps as the tomatoes move under it on a belt conveyor. The tomatoes then move to the sorting unit, which may be a wide conveyor belt or a roller conveyor. Sorters are stationed on one or both sides of this unit. Badly decayed tomatoes are picked out and thrown into a container for later disposal as garbage. Slightly decayed and otherwise defective and soft tomatoes which have merchantable value but are not suitable for table use are placed in separate containers. This stock is known as "soup stock" to the trade, and most dealers have special outlets, such as restaurants or hotels, for the disposal of such stock at reduced prices.

Ripe and firm tomatoes and tomatoes that are turning pink or red are also sorted out separately and replaced in the lug boxes or conveyed directly to packing bins for immediate repacking for the retail trade. The green tomatoes are placed loosely in empty lugs and trucked immediately to the ripening or storage rooms for holding until the tomatoes become ripe. After holding for a few days the tomatoes are again sorted in the same manner. Often it is necessary to sort the green tomatoes from the same shipment several times before all the tomatoes in the shipment are finally ripened.⁵

Mechanized equipment for handling tomatoes in repackers' establishments varies greatly. Some of the large repackers have an elaborate system of conveying belts for handling the various sizes and maturity separations with a minimum of hand labor. Many of the smaller dealers, however, lack such mechanical equipment and employ hand labor to do most of the work.

Methods of packing pink and ripe tomatoes for distribution to retailers and consumers have undergone considerable changes in recent

⁵ Circular 566, The Ripening and Repacking of Mature-Green Tomatoes.

years. It used to be general practice to repack such tomatoes in the lug boxes, after which the retailer would either sell directly from the lugs or remove them to display bins or tables. Under such a system, particularly in self-service stores, losses were rather high owing to consumers' habits of always selecting the best tomatoes and pinching to determine firmness. Packaging in consumer-sized packages seemed to be the way to minimize such losses, so tomatoes became one of the first perishable products to be prepackaged before being offered for sale to consumers. During recent years this method of handling tomatoes has developed to the point that it is almost impossible for consumers in the larger cities to buy tomatoes that are not prepackaged. Repackers not only furnish tomatoes for local distribution but many of them send express shipments of pink and turning stock to customers in cities and towns several hundred miles distant.

The package generally used for prepackaging tomatoes consists of a small folding, oblong, cardboard tray designed to hold from 3 to 6, but more commonly 4 or 5 tomatoes, weighing about a pound. After packing, the trays are wrapped with cellophane and heat-sealed by machines designed for the purpose. The trays are not standardized and each individual repacker orders according to his own ideas as to size and design. Some repackers use two or three different sizes for packing different sizes of tomatoes. The trays now most generally used have replaced a cardboard carton or box of similar dimensions but fitted with a cardboard top with a cellophane window. Some of these are still in use but they are fast disappearing because customers followed the practice in self-service stores of lifting the lids and exchanging pale-colored or defective tomatoes for fully colored, non-defective ones.

PACKING THE TRAYS

Tomatoes are packed in the trays, usually with the blossom end up but sometimes on edge. The open top, covered with cellophane, permits the customer to see from a third to a half of the surface of the tomatoes except at the ends, where less surface of the tomatoes is exposed because of flaps on some types of trays.

Trays are packed by hand labor, usually by girls or women. In some repacking houses the trays move on a conveyor belt past the packers (fig. 26). They come to the repackers folded flat, so they must first be opened up, after which an employee is responsible for placing a continuous supply on the belt. Packers obtain their supply of tomatoes from bins in which a supply is provided by other employees of the house. Sometimes packers select the tomatoes to be packed directly from lug boxes trucked from the sorting belts. In some houses where a large volume is packed each packer places only one tomato in the tray, the first packer starting the package by placing a tomato in one end. The second packer adds a tomato and the succeeding packers do the same until the packages are filled. Such a system is employed only in houses where the packages are marked with the number of tomatoes rather than with the net weight of 1 pound.

When packages are even-weighted to 1 pound, each packer generally has a scales located to one side and she places all the tomatoes in the tray, making the necessary adjustments in her selection of tomatoes to give the required net weight. Sometimes only the last one or two

packers are equipped with scales, and they are responsible for replacing tomatoes to give the required net weight.

Before trays are sealed, an employee usually is responsible for inspecting the filled packages to see that the exposed surfaces of the tomatoes do not show any outstanding defects. Unfortunately, such an employee cannot see the stem ends of the tomatoes, where bruises and discoloration are most likely to appear. Many consumers do not like to purchase tomatoes in the sealed packages because some repackers have not been too careful in seeing that tomatoes with defects on unexposed surfaces have not been packed. The consumer who finds one or more badly defective tomatoes in a package when she opens it is not likely to be a satisfied customer.



PMA 15631

FIGURE 26.—Packers filling cardboard trays with ripe tomatoes, after which the trays are conveyed on a movable belt to the heat-sealing machine.

After the packed trays have passed the inspector they are immediately conveyed into the heat-sealing machine (fig. 27). The work of this machine is entirely automatic. The cellophane used in the machine comes on large spools, which can be fitted into the machine in just a few moments. Sometimes the repacker orders the cellophane printed with certain information, such as the brand name. Most repackers also have the brand name, name of firm, and contents, printed on the trays. Official U. S. Consumer Standards for Tomatoes have not yet been issued by the Department of Agriculture, but most repackers have their trays or cellophane wrappers marked with a term to indicate a grade of superior quality, such as "Fancy," "Fancy Selected," or "Grade A." Very often the quality of the contents of such packages does not warrant the grade term printed on the package.

In judging the maturity of tomatoes to be packed in trays, repackers are guided by the estimated length of time elapsing before the stock will be offered for sale to consumers. Thus, on week ends, before holidays, and for long-distance shipment, they often pack tomatoes just barely turning pink. Complaints are frequently received from retailers that such tomatoes do not ripen properly and often spotting and decay develop before they are sold. Recently the New York City laboratory of the Bureau of Plant Industry, Soils, and Agricultural Engineering, in cooperation with a large distributor, found that packages wrapped tightly did not permit enough ventilation for full



PMA 15627

FIGURE 27.—Heat-sealing machine used for wrapping cardboard trays of ripe tomatoes in cellophane. Unsealed trays enter the machine on a belt at the far end and sealed trays are shown emerging on the belt in the foreground.

development of color. Tomatoes use oxygen and, as a waste product, give off carbon dioxide. A reduction of the former or accumulation of the latter delays ripening. As a result of the experiments, it was determined that the logical safeguard to insure normal ripening would be to puncture the cellophane at the time of wrapping. It was concluded from the experiments that two or three holes about one-eighth inch in diameter would be sufficient.

Repackers almost universally use a flat, corrugated or solid fiberboard carton as a container for packing trays of tomatoes for distribution to local retail stores or for express or truck shipments to other towns and cities (fig. 28). Ten trays of tomatoes to a carton, packed one layer deep, is the number most frequently packed. As

the trays emerge from the heat-sealing machine they are placed in the cartons and closed, after which they are ready for distribution to retailers.

During the summer months, when locally grown pink and ripe tomatoes are available, the problems of the repacker are usually not as great as during the winter months, when he purchases green-wrap stock. He does not have to hold the tomatoes in ripening rooms and re-sort a lot several times before a shipment can be sold. Also, his losses from decay and discoloration are much less than with shipments from distant producing regions.

It remains to be seen whether the present methods of prepackaging and distributing fresh tomatoes offered to consumers will survive.



PMA 15633

FIGURE 28.—Two types of corrugated fiberboard cartons used for packing trays of ripened tomatoes for distribution to retail stores.

Much will depend upon the quality of tomatoes offered for sale in the future. If repackers and chain stores pack a reasonably good quality product, no doubt the system will survive. Many purchasers of prepackaged trays of tomatoes have been dissatisfied with their purchases after they opened the packages because of hidden defects, such as scars and decayed spots, on the stem end of the tomatoes. These, of course, are invisible at the time of purchase. Consumers, however, should not be too critical and expect every tomato to be perfect. They must remember that the tomato is one of the most perishable of our food products and that a small defect that does not cause appreciable waste should not be objectionable, considering the many handlings that tomatoes must go through. Consumers should regard it as a great privilege to be able to enjoy this fruit during all 12 months of the year.